

**2001 Performance Report
General Chemistry and
Microbiology Section**

September 2002

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2002
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2001 PERFORMANCE REPORT
GENERAL CHEMISTRY AND MICROBIOLOGY SECTION

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Laboratory Services Branch

Ontario Ministry of the Environment

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INTRODUCTION

The General Chemistry and Microbiology Section (GCMS) is part of the Ministry of the Environment Laboratory Services Branch. The section is comprised of two units, they are the Water Chemistry and Microbiology Unit. The Water Chemistry Unit identifies and provides quantitative analysis for major ions, nutrients, and physical properties in a variety of matrices. The Microbiology Unit identifies and enumerates indicator bacteria of water and waste waters.

This report provides a brief outline of the analytical quality control (QC) program associated with sample analysis and examines 2001 performance data for each test in the Water Chemistry and Microbiology Units. GCMS strives to maintain a high standard of analytical performance through its quality assurance program. QC is an integral part of this process.

A number of changes have taken place in the General Chemistry and Microbiology Section since the 1999 performance report was issued. The following describes those changes.

METHODS ADDED BY GCMS AFTER OCTOBER 2001.

Fluoride (E3172)

METHODS DISCONTINUED BY GCMS AFTER OCTOBER 2001.

Fluoride (E3369)

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1.0 PERFORMANCE REPORT FORMAT

The parameters are those analysed by the GCMS for 2001.

The performance report is organized alphabetically according to test name (eg. Dissolved Organic Carbon is filed under the heading "Carbon, Dissolved Organic") and second, by the method reference number. Detailed information concerning the format of each page is outlined below:

1.1 TEST DESCRIPTION

<u>TITLE:</u>	The name of the test parameter.
<u>IDENTIFICATION:</u>	
Laboratory	Location where the test is performed.
Method Reference No:	A number assigned by the Quality Management Unit to an analytical test method eg.(E3370).
Product Code:	LIMS code for analysis request.
Sample Type/Matrix:	The various sample types that can be routed to the method.
Method Introduced:	Date that the method was implemented at the laboratory.
Reporting Units:	Unit of measurement in which the results are reported.
Supervisor:	Name of supervisor/manger responsible for the method.

SAMPLING:

The type of container and preservative (if applicable) that is used and minimum volume of sample that is usually required. Any sample preparation that is normally performed in the field, is also indicated (1).

SAMPLE PREPARATION:

Sample preparation techniques which are usually performed at the laboratory before analysis.

ANALYTICAL PROCEDURE:

Brief summary of the analytical method used to determine the parameter.

INSTRUMENTATION:

Type of instrumentation used to perform the test. Automated continuous flow systems consist of a sampler, peristaltic pump, manifold for reagent addition, detection system and readout system. Microcomputers are used to control the operation of analytical equipment and/or data acquisition.

REPORTING:

W and T are low level data qualifiers (2). A value reported as $\leq W$ is interpreted as not present, the value accompanying the remark is the lowest reportable value of the method under routine operating conditions. A value (multiple of W) reported as $\leq WE$ is interpreted as above for $\leq W$ following non-routine dilution of the sample to allow analysis of the target substance. A value reported as $< T$ is interpreted as target substance identified, use caution in interpretation unless more sample data supports this result. A value reported as $< TE$ is interpreted as above for $< T$ following non routine dilution of the sample to allow analysis for the target substance.

To provide a consistent LSB approach to data reporting, GCMS calculates W from the standard deviation of duplicates (S_2), near zero, by rounding down to the nearest 1,2 or 5 digit (4). T is five times W and is defined as the detection limit. The latest calculations, valid at date of publication for W and T values of all active methods, are contained in this report (APPENDIX A).

Data is reported to a maximum of three significant figures.

CALIBRATION:

The number of standards used to calibrate the analytical system plus blanks if applicable.

CONTROLS:

The calibration, drift, recovery, and interference controls that are used when applicable to ensure that the system is operating properly.

MODIFICATIONS:

Modifications made to the test in 2001.

NOTES:

Explanatory notes which may aid the data user in interpreting results and information.

1.2 PERFORMANCE DATA SUMMARY

QUALITY CONTROL DATA FROM/TO:

The period of time over which data were collected.

ANALYTICAL RANGE AND REPORTING UNIT:

The full scale value for the analytical range is given in concentration units.

CALIBRATION CONTROL:

Calibration control includes a table outlining the number of data collected over the selected time period, expected concentrations of the control standards, the calculated mean concentration of these standards, mean bias (mean concentration minus the expected concentration), and standard deviations of each control standard. The between run standard deviation (S), the within run standard deviation (S_w), the ratio S/S_w , and the control limits for standards sums and differences are provided.

RECOVERIES (Where applicable):

The table outlines the number of data collected over the selected time period, expected concentrations of the recovery standards, the calculated mean concentration of these standards, and standard deviations of each recovery standard.

DUPLICATES:

The table outlines within run duplicate data collected over the selected time period. Data are sorted into a number of concentration spans. The standard deviation for duplicates is provided for each range. The coefficient of variation (%) is determined by dividing the mean standard deviation (S_2) for a particular concentration span by the mean concentration of duplicate results in that span and multiplying by 100.

OTHER CHECKS (Where applicable):

The table outlines the number of data collected over a selected time period, the calculated mean concentration of ie., blank, and standard deviation.

1.3 QUALITY CONTROL GRAPHICS

QUALITY CONTROL:

Calibration control standards sums and differences are plotted on a horizontal scale for the period of data collection (referred to on the graphs as "QUALITY CONTROL STANDARD A+B" for example). The vertical scale consists of the warning/control limits expressed on either side of the expected value. These limits were chosen from analytical performance data.

2.0 ANALYTICAL QUALITY CONTROL PROGRAM

Quality control is a continuous process that involves constant checks of sample processing procedures. This report summarizes the QC data collected during analytical processing to monitor performance of the analytical system.

Calibration Standards are verified for identity, purity and concentration accuracy by comparison against independent sources wherever possible. A series of calibration standards are analyzed covering the analytical range.

Once a system has been calibrated, quality control begins. Depending on the analytical procedure, quality control may be used to evaluate: calibration, blank, recovery, sensitivity, potential interference, and sample repeatability.

Calibration and Blank

Calibration is controlled by a minimum of two quality control standards and a long term blank which are prepared and maintained independently of the calibration standards. The system is not calibrated with the quality control standards. The long term blank is Pure De-ionized Water (Pure-DW) used to prepare the quality control standards and has zero concentration of the target analyte. Control standards are prepared less frequently than calibration standards and errors in newly prepared calibration standards can be detected by this cross check. Newly prepared control standards are run in parallel with in-use control standards and must meet control requirements over three consecutive runs before the new standards are accepted for routine use.

The standard deviation of the control standards is used to estimate the between-run standard deviation (S) and is compared against the within-run standard deviation (S_w). If the ratio S/S_w exceeds 1.5 then poor control of systematic error can be inferred (3). Values for S and S_w are calculated as follows:

$$2S^2 = (S_A)^2 + (S_B)^2 \qquad 2S_w^2 = (S_{A-B})^2$$

Where

S_A = standard deviation (s.d.) of control standard A

S_B = s.d. of control standard B

S_{A-B} = s.d. of the difference between control standards A and B

NOTE: If a second range is employed for a test, more control standards are used because, in many systems, the between-run standard deviations are concentration dependent.

Detailed description of the quality control processes are outlined in several LSB documents (2)(4)(5) and (6).

Control/Warning Limits

The control standards data are assessed and compared against the control/warning limits established from previous data to determine whether the calibration process is in control. The limits are set up initially based on method performance(4), and are reviewed when method and/or performance data reviews are conducted to determine if modifications are required based on historical data calculations. Control limits are calculated for the sums and differences of control standards (A,B,C,D) by the equations:

$(A+B) \pm 4(S_{A-B})$ for the sum of A+B

$(B+C) \pm 4(S_{B-C})$ for the sum of B+C

$(C+D) \pm 4(S_{C-D})$ for the sum of C+D

$(A-B) \pm 3(S_{A-B})$ for the difference of A-B

$(B-C) \pm 3(S_{B-C})$ for the difference of B-C

$(C-D) \pm 3(S_{C-D})$ for the difference of C-D

Note: Warning Limits are calculated by the same formulae above (using ± 2 instead of 4 and 3 respectively).

If a control limit is exceeded, the analysis is stopped, corrective action taken and the control standards are re-analysed.

Recovery

Some methods require sample pre-treatment, such as digestion or extraction. A recovery check, suitable to that method, is required to estimate the efficiency of the pre-treatment. Recovery standards are usually prepared at 0%, 20% and 80% of full scale. The solutions are analysed in the same manner as routine samples. Although these solutions are not used to calibrate the instrument, corrections for the blank and matrix effects are calculated and applied if necessary. For an analytical run to be accepted, the recoveries should be within $\pm(5\% + T/2)$ of their expected values. (See Section 1.1 "Reporting" for T determination). The average blank should be within three standard deviations of its historical mean. If a second range is employed for a test, at least one additional recovery standard is used.

Sensitivity and Baseline

Any change in the sensitivity of the instrumentation is monitored periodically during the run, as defined by the method, by analysing a standard that is usually 80% of full scale, and comparing the reading to the original calibration standards. Baseline drift is usually recorded by periodic analysis, as defined by the method, of Pure-DW which does not contain any of the analyte, but may be treated to correspond to sample pre-treatment.

Interference

The interference check is run on any test where a substance may be present in concentrations that affect the results. The check is carried out near the threshold concentration of the interfering substance, beyond which the methodological safeguards used to minimize the interference are

no longer effective. The check indicates that the interference has no effect up to the specified concentrations.

Sample Repeatability

Generally, one sample out of twenty is analysed in duplicate up to a maximum of three duplicates per analytical run. The samples are selected for non-adjacent, within-run duplicate analyses. By analysing samples in duplicate, the ability of the analyst to obtain repeatable analytical results, within an analytical run, can be determined. For results to be acceptable, at least two of the three duplicate pairs must conform to limits that are set based on historical performance.

Duplicate: data are accumulated and usually sorted into 3 ranges of 0-10 or 0-20, 21-50, 51-100 percent of full scale. More ranges may be added where the analytical scale spans are greater than 2 log scales. A standard deviation is calculated for each concentration range. The algorithm differs from the conventional standard deviation as follows:

Conventional Std. Dev. (1)*

$$S_1 = \sqrt{\frac{\sum_{i=1}^n (\bar{x} - x_i)^2}{n-1}}$$

Std. Dev. of Duplicates (2)*

$$S_2 = \sqrt{\frac{\sum_{i=1}^{n'} (x_1 - x_2)_i^2}{2n'}}$$

* Standard deviations used for the data summaries.

Where

S_1 = sample standard deviation

S_2 = duplicate difference standard deviation

n = number of data

$\bar{x}$ = mean of data

x_i = i^{th} result

$(x_1 - x_2)_i$ = difference of the i^{th} duplicate

n' = number of duplicate pairs

The standard deviation (S_2) of the duplicate difference is also expressed as the coefficient of variation (CV).

$$CV = \frac{S_2}{\bar{X}} \times 100$$

2.1 PERFORMANCE SUMMARIES

ACIDITY, GRAN

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/08/82
Method Reference No	E3248	Reporting Units	$\mu\text{eq/L as H}^+$
LIMS Product Code	PHACD3248	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Raw Sewage, Drinking Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

Sample aliquots (50.0 mL) are titrated with 0.01 N sodium hydroxide to pH >8.3. The titrant is standardized against 0.0005 N potassium hydrogen phthalate. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH readings following each aliquot of titrant. Data are subjected to Gran analysis. pH and total fixed endpoint acidity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 5	Current T value: 25
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CALIBRATION:

2 standard buffers covering the pH range of 4 to 9, titrant standardization against 0.0005 N potassium hydrogen phthalate.

CONTROLS:

Calibration	Long Term Blank plus 2 standards, e.g. QCA
-------------	--

NOTES:

Oct '99. The W value of 1 and T value of 5 were changed to 5 and 25 respectively based on historical data.

ACIDITY, GRAN (E3248)

QUALITY CONTROL DATA FROM 21/01/97 TO 05/09/01

Analytical Range: to 1000 µeq/L as H⁺

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	70	500.0	507.7	7.7	12.0599
B:	70	200.0	200.3	0.3	7.0149
A+B:		700.0	707.9	7.9	16.5164
A-B:		300.0	307.4	7.4	10.7938

s.d.(AB)

S(between runs): 9.87

Sw(within run): 7.63

S/Sw: 1.3

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

662 - 738 for A+B
272 - 328 for A-B

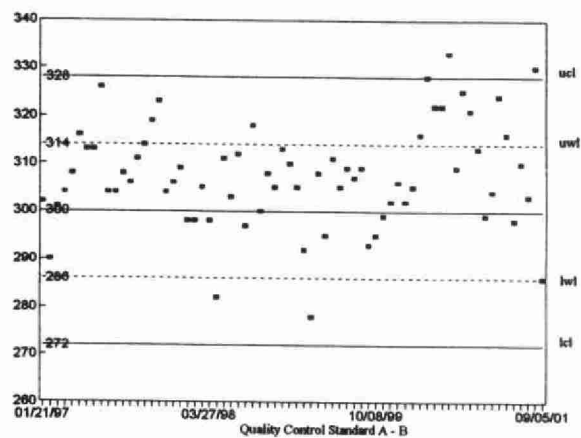
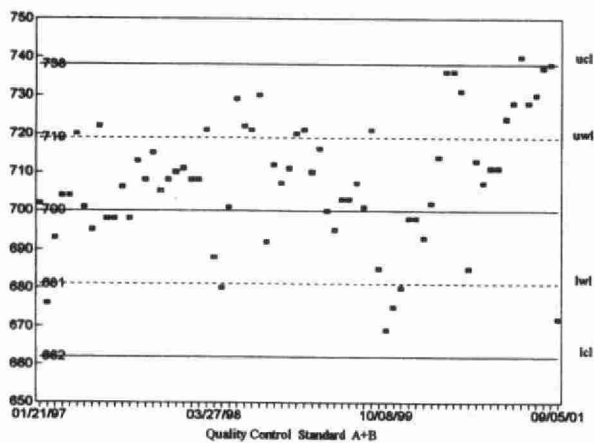
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
130	0 - 100	5.0395	8.9
32	101 - 250	7.6893	5.7
1	250 - 500	N.A.	N.A.
163	Overall	5.7990	

ACIDITY, GRAN (E3248)

QUALITY CONTROL DATA FROM 21/01/97 TO 05/09/01

Analytical Range: to 1000 $\mu\text{eq/L}$ as H^+



ACIDITY, TOTAL FIXED ENDPOINT

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/08/82
Method Reference No.	E3248	Reporting Units	mg/L as CaCO ₃
LIMS Product Code	PHACD3248	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Raw Sewage, Drinking Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

Sample aliquots (50.0 mL) are titrated with 0.01 N sodium hydroxide to pH >8.3. The titrant is standardized against 0.0005 N potassium hydrogen phthalate. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH readings following each aliquot of titrant. pH and gran acidity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

2 standard buffers covering the pH range of 4 to 9, titrant standardization against 0.0005 N potassium hydrogen phthalate.

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
-------------	---------------------------------

NOTES:

Oct '99. The W value of 0.05 and T value of 0.25 were changed to 0.2 and 1.0 respectively based on historical data.

ACIDITY, TOTAL FIXED ENDPOINT (E3248)

QUALITY CONTROL DATA FROM 21/01/97 TO 05/09/01

Analytical Range: to 100 mg/L as CaCO₃

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	68	25.0	25.40	0.40	0.6382
B:	68	10.0	9.95	-0.05	0.3710
A+B:		35.0	35.35	0.35	0.8762
A-B:		15.0	15.45	0.45	0.5675

s.d.(AB)

S(between runs): 0.52

Sw(within run): 0.40

S/Sw: 1.3

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

32.8 - 37.2 for A+B
13.4 - 16.6 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
97	0.0 - 4.0	0.1060	3.9
58	4.1 - 10.0	0.4970	8.8
5	10.1 - 20.0	0.3386	2.6
150	Overall	0.3171	

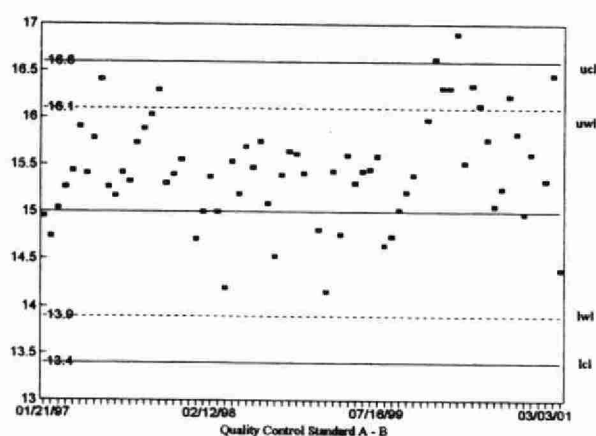
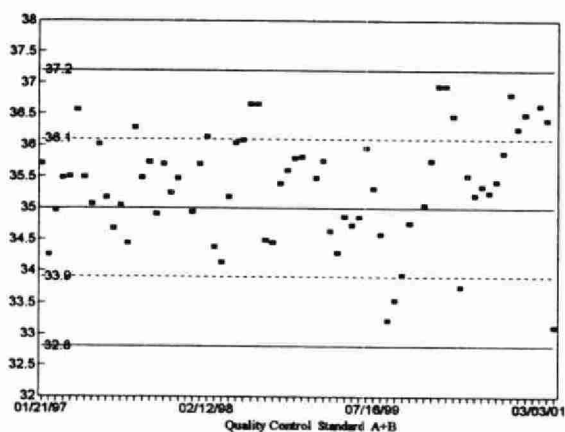
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	67	0.0463	0.1706

ACIDITY, TOTAL FIXED ENDPOINT (E3248)

QUALITY CONTROL DATA FROM 21/01/97 TO 05/09/01

Analytical Range: to 100 mg/L as CaCO_3



ALKALINITY, TOTAL FIXED ENDPOINT

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No.	E3218	Reporting Unit	mg/L as CaCO ₃
LIMS Product Code	PHALCO3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

Samples (20.0 mL) are titrated with 0.02 N sulphuric acid to pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.

pH, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
--------------------------------	----------------------	----------------------

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9, titrant standardization against 0.002 N sodium carbonate.

CONTROLS:

Calibration	BL plus 4 standards, e.g. QCA
Drift	In run standards throughout the run (tap water diluted to 50% V/V)

NOTES:

May '97 the W value was changed from 0.2 to 0.5 after a review of 2 years low level duplicate data '94-95.

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 08/01/01 TO 24/12/01

Analytical Range: to 1000 mg/L as CaCO_3

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	105	250	250.68	-0.68	1.4547
B:	105	100	100.57	-0.57	0.7290
C:	105	25	24.86	0.14	0.4420
D:	105	2.5	2.43	0.07	0.1362
A+B:		350	351.25	-1.25	1.7491
A-B:		150	150.11	-0.11	1.4953
B+C:		125	125.43	-0.43	0.8250
B-C:		75	75.71	-0.71	0.8793
C+D:		27.5	27.29	0.21	0.4507
C-D:		22.5	22.44	0.06	0.4740

s.d.(AB)	S(between runs): 1.15	Sw(within run): 1.06	S/Sw: 1.1
s.d.(BC)	S(between runs): 0.60	Sw(within run): 0.62	S/Sw: 1.0
s.d.(CD)	S(between runs): 0.33	Sw(within run): 0.34	S/Sw: 1.0

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

343	-	357	for	A+B
144.76	-	155.24	for	A-B
121.5	-	128.5	for	B+C
72.4	-	77.6	for	B-C
25.82	-	29.18	for	C+D
21.24	-	23.76	for	C-D

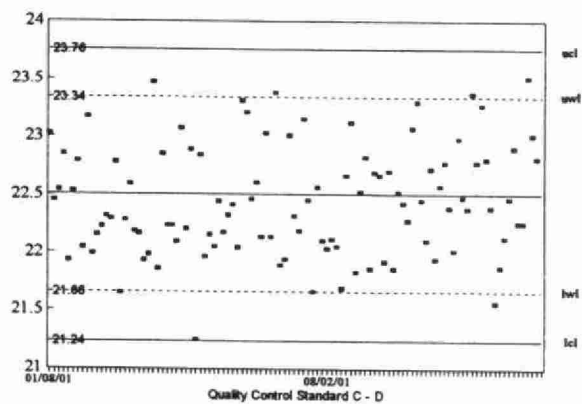
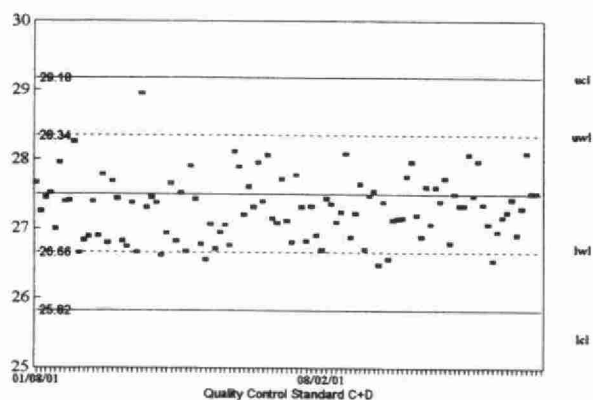
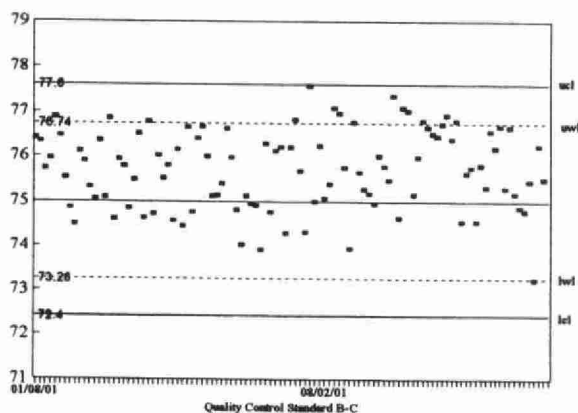
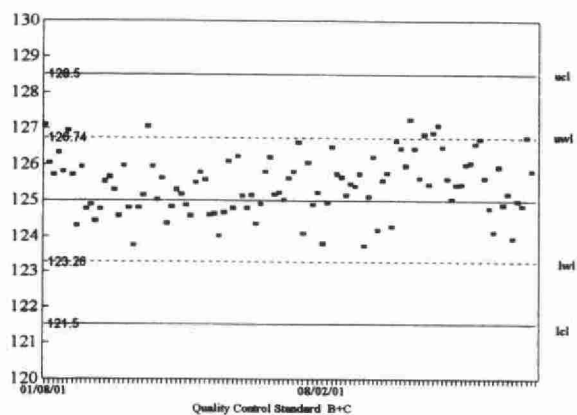
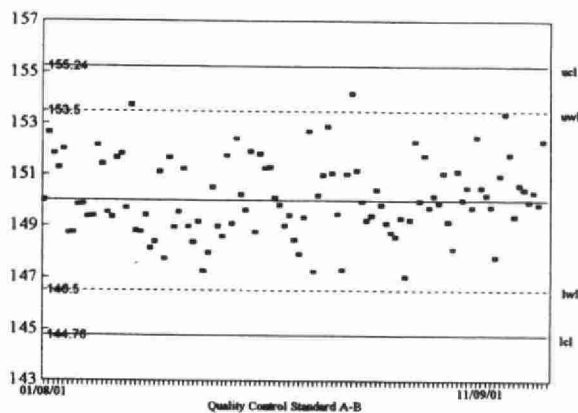
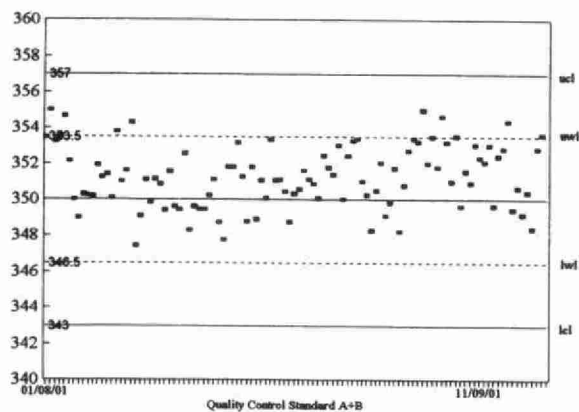
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
118	0 - 50	0.4571	0.8
156	51 - 100	0.4571	0.6
21	101 - 300	1.1007	0.8
22	301 - 1000	3.6121	0.8
295	Overall	1.2931	

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 08/01/01 TO 24/12/01

Analytical Range: to 1000 mg/L as CaCO_3



CARBON, DISSOLVED INORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.3 at the full scale level.

Dissolved organic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO₂-free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL, standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by a Labtronics / in-house Visual Basic application.

CARBON, DISSOLVED INORGANIC (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 12/12/01

Analytical Range: to 80.0 mg/L as C

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	61	64.0	64.02	0.02	0.6147
B:	61	16.0	15.83	-0.17	0.3722
C:	61	4.00	4.05	0.05	0.2188
A+B:		80.0	79.85	-0.15	0.7754
A-B:		48.0	48.19	0.19	0.6568
B+C:		20.0	19.88	-0.12	0.5272
B-C:		12.0	11.72	-0.22	0.3080

s.d.(AB)

S(between runs): 0.51

Sw(within run): 0.46

S/Sw: 1.1

s.d.(BC)

S(between runs): 0.31

Sw(within run): 0.22

S/Sw: 1.4

The calibration is accepted if the calibration control values obtained lie within the ranges:

77.86	-	82.14	for	A+B
46.4	-	49.6	for	A-B
18.83	-	21.17	for	B+C
11.12	-	12.88	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
47	0.00 - 16.0	0.2000	3.2
89	16.1 - 40.0	0.2966	1.2
41	40.1-80.0	0.4311	0.8
177	Overall	0.3129	

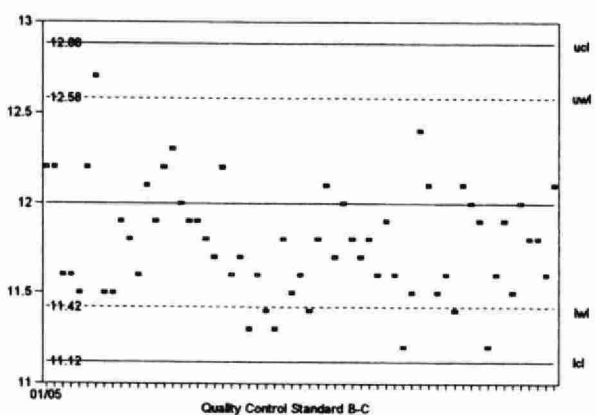
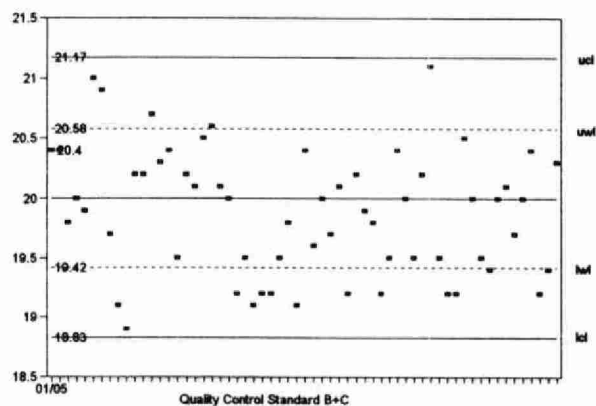
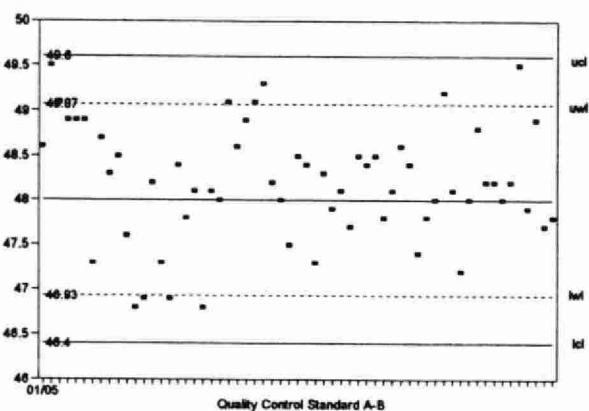
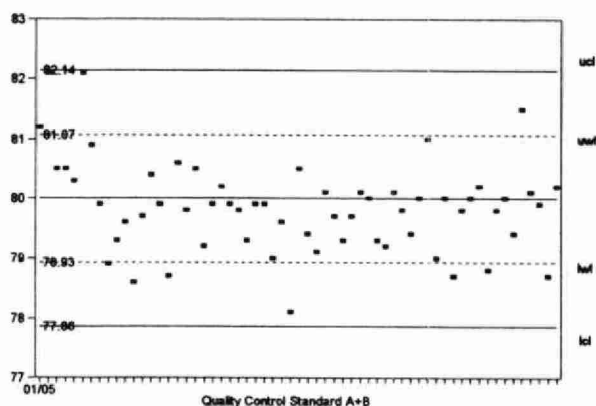
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	61	0.2098	0.2827

CARBON, DISSOLVED INORGANIC (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 12/12/01

Analytical Range: to 80.0 mg/L as C



CARBON, DISSOLVED ORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level. Dissolved inorganic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO₂ -free) supplies with flow controls, dialysis unit, UV digester. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture, reduction, and processing via a multi-stage microcomputer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by Labtronics.

CARBON, DISSOLVED ORGANIC (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 20/12/01

Analytical Range: to 20.0 mg/L as C

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	61	16.0	15.95	-0.05	0.1444
B:	61	4.00	3.94	-0.06	0.1531
C:	61	1.00	0.96	-0.04	0.1406
A+B:		20.0	19.89	-0.11	0.1931
A-B:		12.0	12.01	0.097	0.2265
B+C:		5.00	4.90	-0.10	0.2536
B-C:		3.00	2.98	-0.02	0.1485

s.d.(AB) S(between runs): 0.1488

Sw(within run): 0.1601

S/Sw: 0.9

s.d.(BC) S(between runs): 0.1469

Sw(within run): 0.1050

S/Sw: 1.4

The calibration is accepted if the calibration control values obtained lie within the ranges:

19.44	-	20.56	for	A+B
11.58	-	12.42	for	A-B
4.56	-	5.44	for	B+C
2.67	-	3.33	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
59	0.00 - 2.00	0.1305	10.4
73	2.01 - 4.0	0.1767	6.2
43	4.01 - 10.0	0.1210	2.1
2	10.01 - 20.0	0.2550	2.2
177	Overall	0.1507	

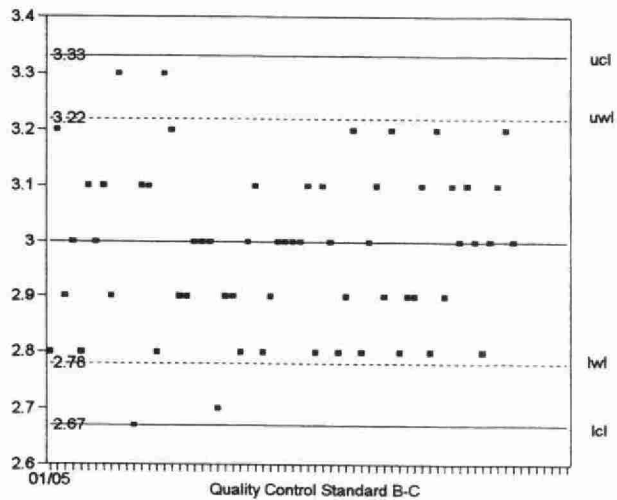
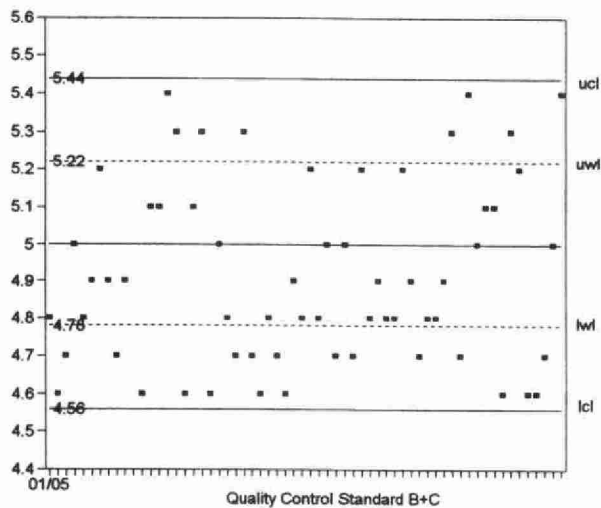
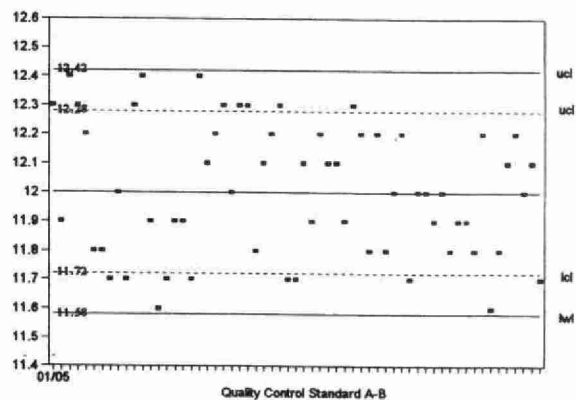
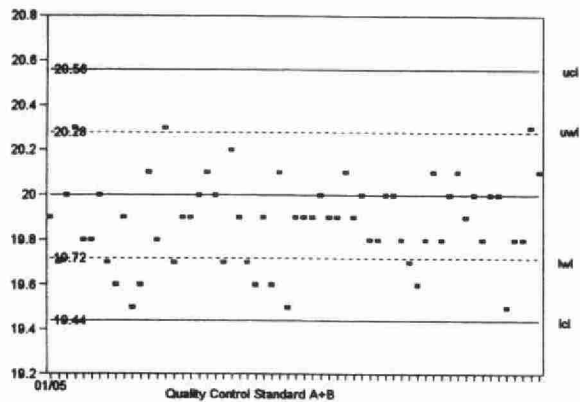
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	61	0.0049	0.1532

CARBON, DISSOLVED ORGANIC (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 20/12/01

Analytical Range: to 20.0 mg/L as C



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Reporting Unit	$\mu\text{g}/\text{m}^3$ as Cl
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air, HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" filter strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation. The result is reported as $\mu\text{g}/\text{m}^3$ as Cl.

Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:

6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2
Drift	Duplicate plus 2 standards approximately every 20 samples

CHLORIDE cont'd

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of Cl in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

CHLORIDE (E3004)

QUALITY CONTROL DATA FOR 2001

Analytical Range: to 14.31 $\mu\text{g}/\text{m}^3$

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
65	0.0 - 2.86	0.020	6.3
2	2.89 - 7.15	N.A.	N.A.
0	7.18 - 14.31	N.A.	N.A.
67	Overall	0.027	

CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Reporting Unit	µg/g as Cl
LIMS Product Code	ANION3013, CL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0 g sample air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as Cl. Sulphate is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g
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CALIBRATION:

8 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2
Drift	Duplicate plus 2 standards approximately every 20 samples

CHLORIDE (E3013)

QUALITY CONTROL DATA FOR 2001

Analytical Range: to 1000 µg/g

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
31	0.0 - 200	0.3911	1.6
3	201 - 500	4.906	1.6
1	500 - 1000	N.A.	N.A.
35	Overall	1.7085	

CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/75
Method Reference No.	E3016	Reporting Unit	mg/L as Cl
LIMS Product Code	CL3016	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	10 mL
Container:	Plastic

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically.

Approximate absorbance: 0.5 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 1.5 cm light path at 480 nm.

Data capture and processing via a multistage microcomputer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1
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CALIBRATION:

BL plus 12 standards

CONTROLS:

Calibration:	LTBL plus 3 standards, e.g. QCA
Drift:	BL and standard after every 12 samples

NOTES:

April 1998: The HP data capture/processing system was replaced by Labtronics. Two additional Calibration standards were added at the low end of the curve.

CHLORIDE (E3016)

QUALITY CONTROL DATA FROM 02/01/01 TO 21/12/01

Analytical Range: to 100 mg/L as Cl

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	96	75.00	75.30	0.30	0.3151
B:	96	25.00	25.12	0.12	0.1475
C:	96	5.00	4.89	-0.11	0.0670
A+B:		100.00	100.42	0.42	0.3599
A-B:		50.00	50.19	0.19	0.3355
B+C:		30.00	30.01	0.01	0.1770
B-C:		20.00	20.22	0.22	0.1455

s.d.(AB) S(between runs):0.25

s.d.(BC) S(between runs):0.12

Sw(within run): 0.24

Sw(within run): 0.10

S/Sw: 1.0

S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

98.7	-	101.3	for	A+B
49	-	51	for	A-B
29.3	-	30.7	for	B+C
19.5	-	20.5	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
47	0.00 - 10.0	0.0875	1.8
61	10.1 - 20.0	0.1519	1.0
107	20.1 - 50.0	0.2147	0.7
41	50.1 - 100	0.3394	0.5
256	Overall	0.2113	

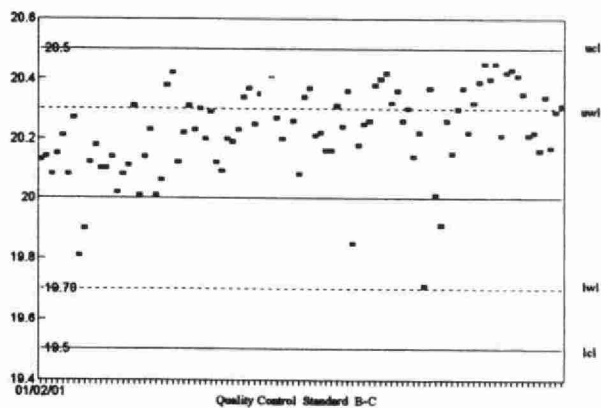
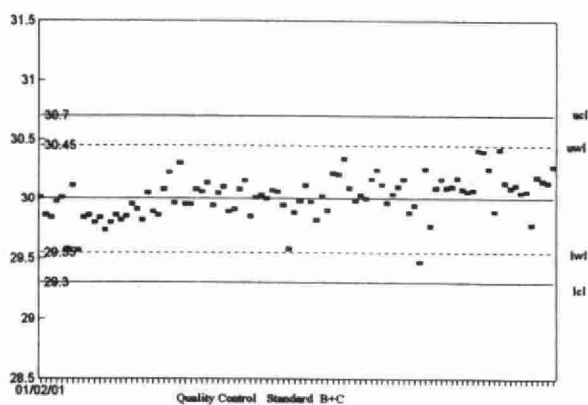
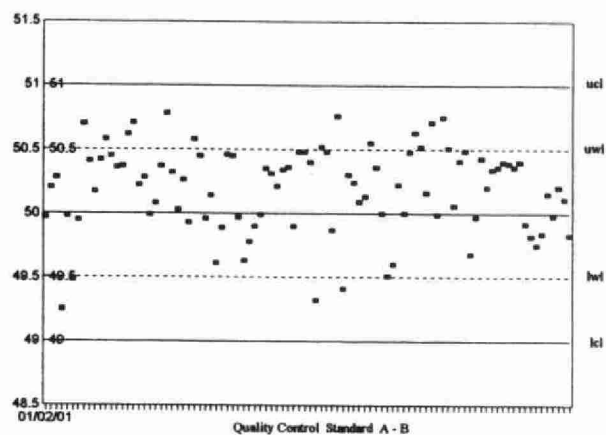
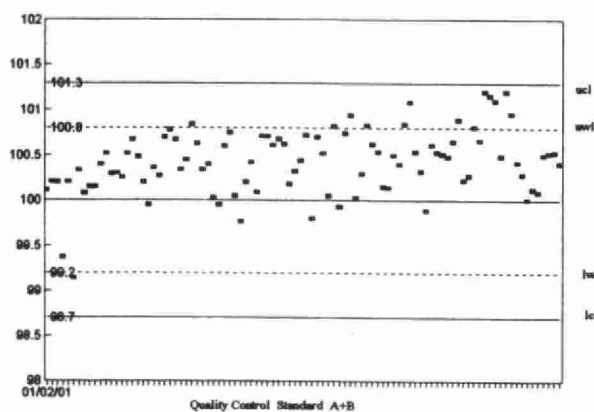
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	96	0.068	0.0716

CHLORIDE (E3016)

QUALITY CONTROL DATA FROM 02/01/01 TO 21/12/01

Analytical Range: to 100 mg/L as Cl



CHLOROPHYLL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/75
Method Reference No	E3169	Reporting Unit	µg/L
LIMS Product Code	CHL3169	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	1000 mL for clear samples; 500 mL if visibly green
Container	Glass or plastic
Other	In the field a sample is filtered through a nylon filter. The filter is folded and then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish labelled with the sample number and sample volume filtered, the dish is kept in the dark or wrapped in aluminum foil, and shipped immediately, or kept frozen.

ANALYTICAL PROCEDURE:

Using an IBM clone microcomputer-controlled, automated spectrophotometer, two scans are developed with absorbance measurements at 630, 645, and 663 nm for the first scans; the minimum absorbance value between 710 and 750 nm (readings at 5 nm intervals) is utilized as a turbidity correction. Chlorophyll "a" and "b" are calculated from this scan. After automated acidification, the second scan is obtained from the wavelength 665 nm for correcting chlorophyll "a" measurement. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

- Automated modular continuous flow scanning spectrophotometer system
- Microcomputer system for control of sampling, timing and data processing (i.e. data capture, calculations and transfer of results to LIMS)

REPORTING:

Chlorophyll a; corrected	Maximum Significant Figures: 3	Current W value: 1.0	Current T value: 5.0
Chlorophyll a; total		Current W value: 0.2	Current T value: 1.0
Chlorophyll b; total		Current W value: 0.1	Current T value: 0.5

CONTROLS:

Calibration	LTBL plus 2 "standards", e.g.QCA
Drift	"standard", BL every 20 samples

NOTES:

"Standards" are prepared from chlorophyll "a" and "b", but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

NOTES (cont):

Jan 1999, the microcomputer system was replaced with a 486 P.C. The software written in PET BASIC was replaced by software written in CLIPPER.

May 2000 the Bechman DU7 spectrophotometer was replaced with a Bechman DU600 instrument.

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	45	3.0	3.06	0.06	0.1286
B:	45	1.0	1.02	0.02	0.0792
A+B:		4.0	4.08	0.08	0.1724
A-B:		2.0	2.04	0.04	0.1260

s.d.(AB)

S(between runs): 0.11

Sw(within run): 0.09

S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6 - 4.4 for A+B
1.7 - 2.3 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
7	0 - 5.0	0.1230	10.7
5	5.1 - 10.0	0.7398	10.9
4	10.1 - 25.0	0.7550	4.6
16	Overall	0.5658	

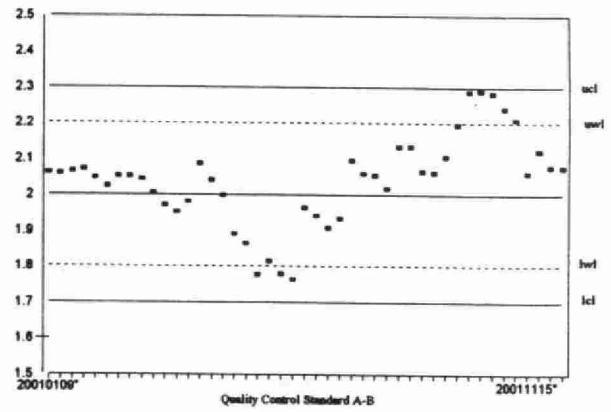
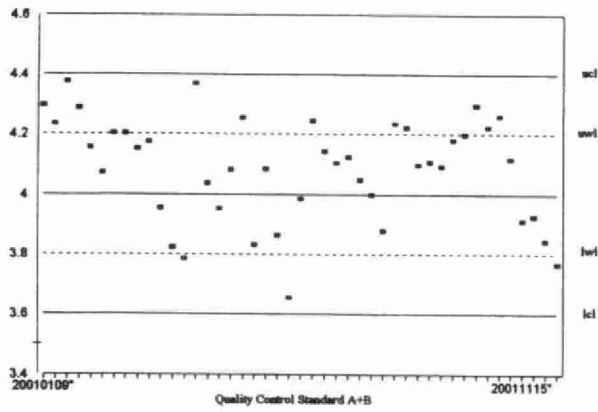
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	45	0.0466	0.0647
Filtered Blank	45	0.0609	0.0828

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	35	2.4	2.73	0.33	0.1505
B:	35	0.8	0.93	0.13	0.0887
A+B:		3.2	3.65	0.45	0.2206
A-B:		1.6	1.80	0.20	0.1112

s.d.(AB)

S(between runs): .13

Sw(within run): 0.08

S/Sw: 1.6

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.4 - 4.0 for A+B
1.0 - 2.2 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
5	-0.5 - 1.0	0.2268	35.2
0	1.1 - 2.0	N.A.	N.A.
2	2.1 - 5.0	0.0461	1.1
6	5.1 - 10.0	0.0604	7.9
0	10.1 - 100	N.A.	N.A.
14	Overall	0.4182	

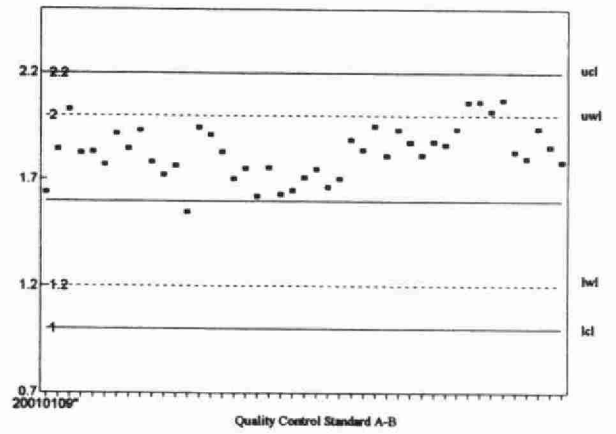
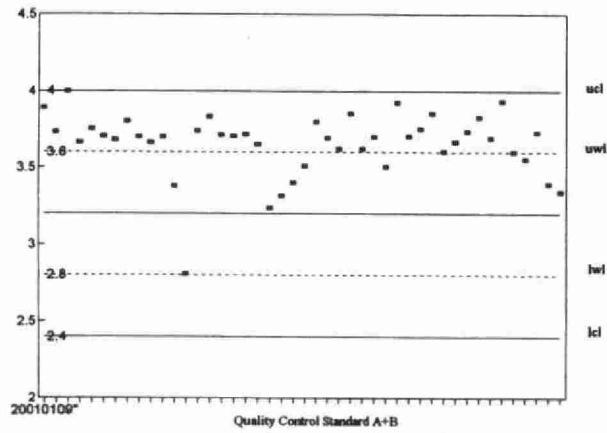
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	35	0.0629	0.0675
Filtered Blank	35	0.0765	0.0903

CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	45	3.0	2.88	-0.12	0.1106
B:	45	1.0	0.98	-0.02	0.0752
A+B:		4.0	3.86	-0.14	0.1757
A-B:		2.0	1.90	-0.10	0.0700

s.d.(AB)

S(between runs):0.10

Sw(within run): 0.05

S/Sw: 1.9

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6 - 4.4 for A+B
1.7 - 2.3 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
5	0 - 1.0	0.2254	29.8
3	1.1 - 2.0	0.1224	8.0
2	2.1 - 5.0	0.0934	3.5
10	Overall	0.1779	

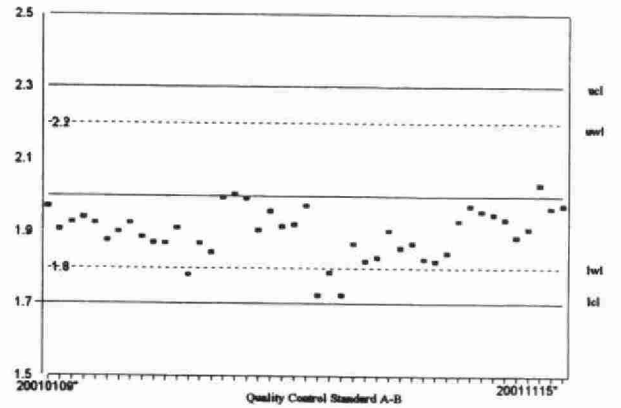
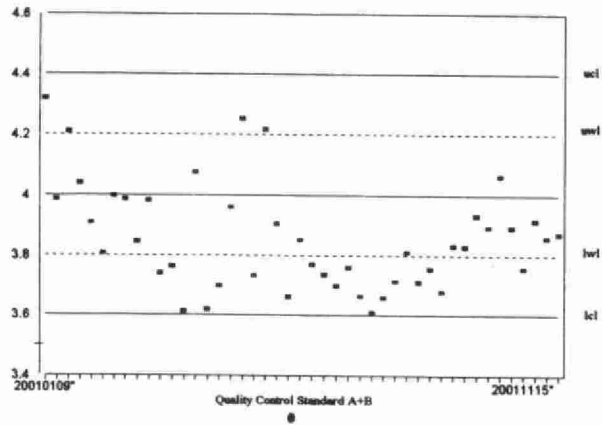
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	45	0.0605	0.0892
Filtered Blank	44	0.0746	0.1079

CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 09/01/01 TO 18/12/01

Reporting Unit: $\mu\text{g/L}$



COLOUR, TRUE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	13/03/84
Method Reference No.	E3219	Reporting Unit	TCU
LIMS Product Code	COL3219	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

Approximate absorbance: 0.3 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450 nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm). Data capture, and processing via a multi-stage microcomputer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	BL and standard after every 10 samples

NOTES:

The HP data capture/processing system was replaced by Labtronics in November 1998.

COLOUR, TRUE (E3219)

QUALITY CONTROL DATA FROM 16/01/01 TO 27/12/01

Analytical Range: to 100 TCU

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	45	70.0	70.50	0.50	0.4377
B:	45	25.0	25.32	0.32	0.4369
C:	45	7.5	6.97	-0.53	0.2990
A+B:		95.0	95.82	0.82	0.7541
A-B:		45.0	45.18	0.18	0.4430
B+C:		32.5	32.30	-0.20	0.6714
B-C:		17.5	18.35	0.85	0.3313

s.d.(AB) S(between runs): 0.44
s.d.(BC) S(between runs): 0.31

Sw(within run): 0.37
Sw(within run): 0.23

S/Sw: 1.4
S/Sw: 1.6

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

92.2	-	97.8	for	A+B
42.9	-	47.1	for	A-B
30.6	-	34.3	for	B+C
16.1	-	18.9	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
80	0.0 - 10.0	0.3966	16.4
17	10.1 - 20.0	0.5689	3.9
26	20.1 - 50.0	0.3500	1.1
1	50.1 - 100.0	N.A.	N.A.
124	Overall	0.4152	

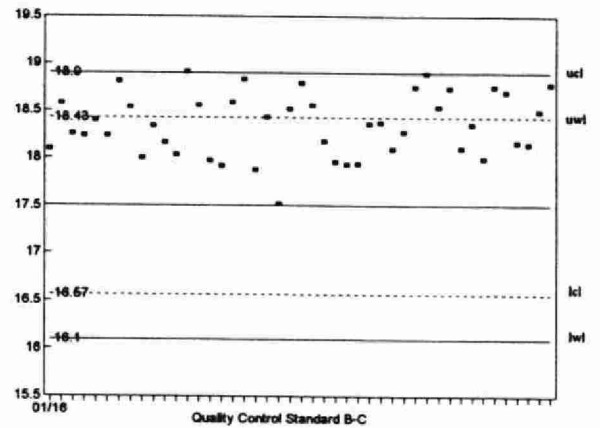
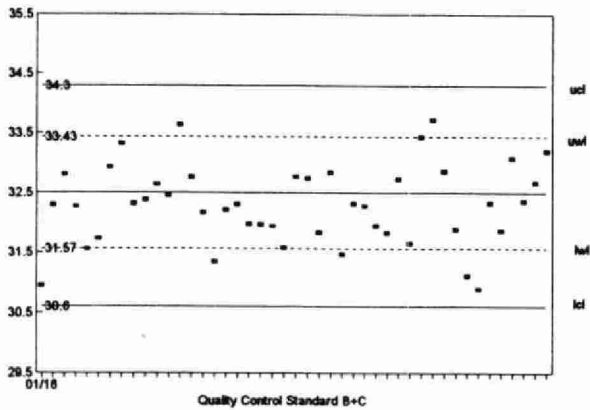
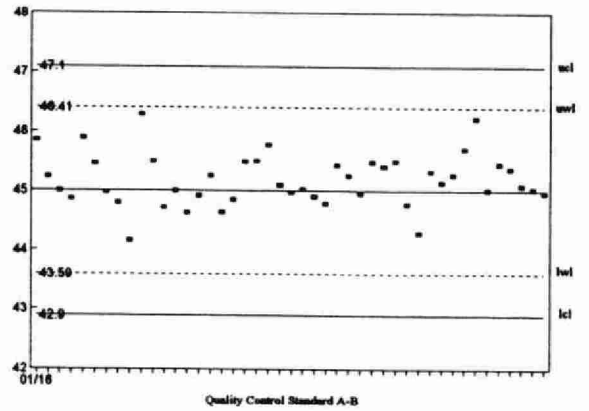
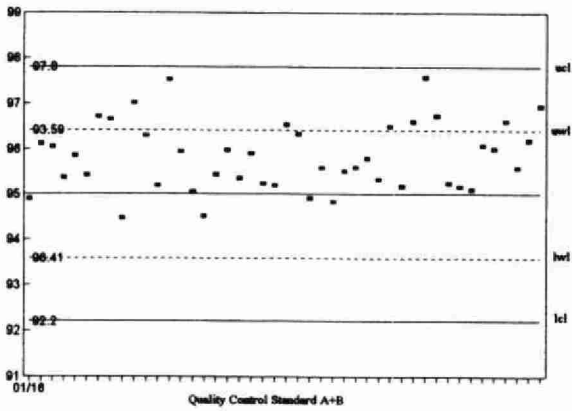
OTHER CHECKS:

	n	Data Mean	Standard (1) Deviation
Long Term Blank	45	-0.602	0.3327

COLOUR, TRUE (E3219)

QUALITY CONTROL DATA FROM 16/01/01 TO 27/12/01

Analytical Range: to 100 TCU



CONDUCTIVITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced:	01/04/74
Method Reference No:	E3218	Reporting Units:	$\mu\text{S/cm}$ at 25°C
LIMS Product Code:	PHALCO3218, CONDPH3218	Supervisor:	P. Wilson
Sample Type/Matrix:	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

After equilibration at room temperature, the conductivity of the sample is measured. Temperature compensation is applied by the system. Total fixed endpoint alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Automated modular continual flow conductivity system comprising of a sampler and conductivity meter with cell plus microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CONTROLS:

Calibration:	LTBL plus 4 standards, e.g. QCA
Drift:	In run standards throughout the run (tap water diluted to 50% V/V)

CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 05/01/01 TO 24/12/01

Analytical Range: to 2000 µS/cm

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	107	1413	1412.90	-0.10	3.2879
B:	107	718	719.65	1.65	2.0471
C:	107	147	148.39	1.40	0.8002
D:	107	37.1	38.42	1.33	0.3004
A+B:		2131	2132.55	1.55	4.4153
A-B:		695	693.24	-1.76	3.2414
B+C:		865	868.05	3.05	2.0618
B-C:		571	571.26	0.26	2.3261
C+D:		184.1	186.81	2.71	0.8711
C-D:		109.9	109.97	0.07	0.8410

s.d.(AB) S(between runs): 2.74

Sw(within run): 2.29

S/Sw: 1.2

s.d.(BC) S(between runs): 1.55

Sw(within run): 1.65

S/Sw: 0.9

s.d.(CD) S(between runs): 0.61

Sw(within run): 0.60

S/Sw: 1.0

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

2109.8	-	2152.2	for	A+B
679.1	-	710.9	for	A-B
851.9	-	878.1	for	B+C
561.2	-	580.8	for	B-C
180.04	-	188.16	for	C+D
106.86	-	112.94	for	C-D

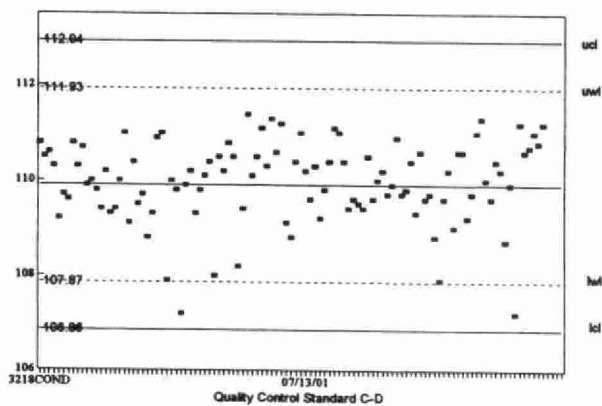
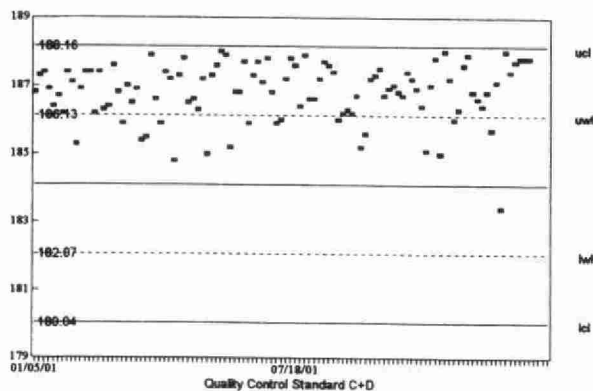
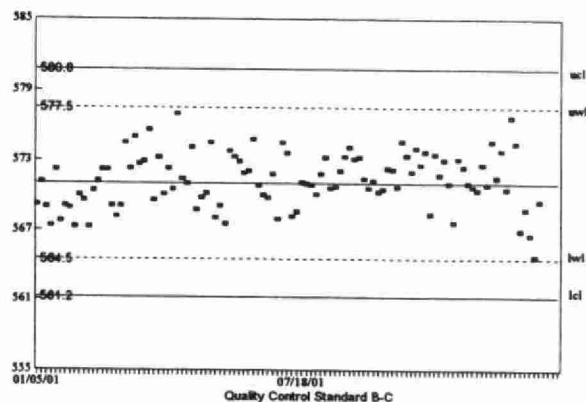
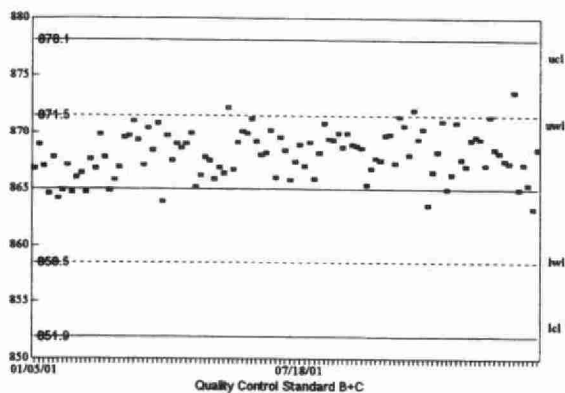
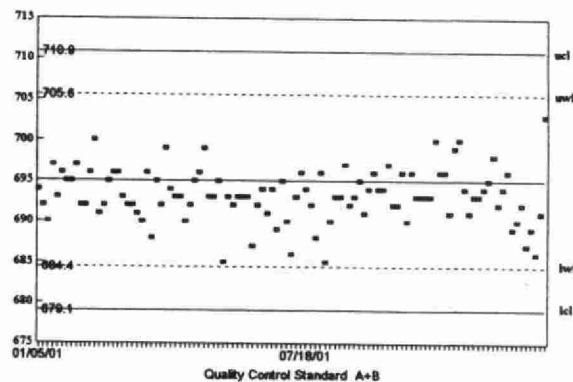
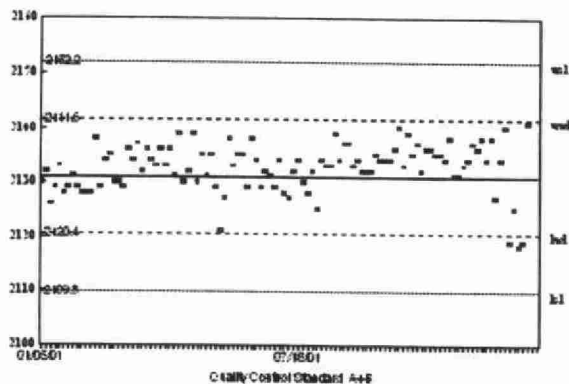
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
64	0 - 200	1.1392	1.2
74	201 - 400	2.6636	0.9
128	401 - 1000	3.9165	0.6
25	1001 - 2000	8.8125	0.7
17	2001 - 10000	15.3393	0.5
308	Overall	5.2564	

CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 05/01/01 TO 24/12/01

Analytical Range: to 2000 $\mu\text{S}/\text{cm}$



CYANIDE, FREE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN^- Solid: $\mu\text{g/g}$ as CN^-
LIMS Product Code	CNF3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Soil, Sediment, Vegetation, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Free cyanides are the simple and weakly dissociable cyanides which form HCN upon acidification to pH4.0 (such as HCN and KCN). The automated determination of free cyanide exposes the sample to distillation which isolates HCN under specific acidic conditions. A zinc sulphate solution is included which eliminates interference from complexed iron cyanides. Cyanide is determined colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system by an autosampler. Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours and then centrifuged. The supernatant is decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as $\mu\text{g/g}$ wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm.

Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3 down to the nearest W	Current W value: 0.001 mg/L 0.01 $\mu\text{g/g}$	Current T value: 0.005mg/L 0.05 $\mu\text{g/g}$
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CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 11/02/98 TO 17/12/01

Analytical Range: to 0.2 mg/L as CN

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	53	0.15	0.1514	0.0014	0.0033
B:	53	0.02	0.0186	-0.0014	0.0012
A+B:		0.17	0.1699	-0.0001	0.0036
A-B:		0.13	0.1328	0.0028	0.0035

s.d.(AB)

S(between runs): 0.0025

Sw(within run): 0.0024

S/Sw: 1.0

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.154 - 0.186 for A+B
0.118 - 0.142 for A-B

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	53	0.10	0.0976	-0.0024	0.0074
FeCN:	53	0.10	0.0102	-0.0898	0.0119
CLP Soil:(0.2g)	24	44.70	46.8959	2.1959	3.2560
(0.1g)	20	44.70	53.1080	8.4080	1.9214

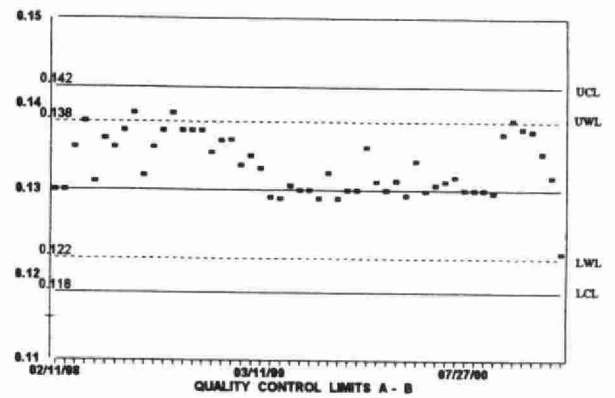
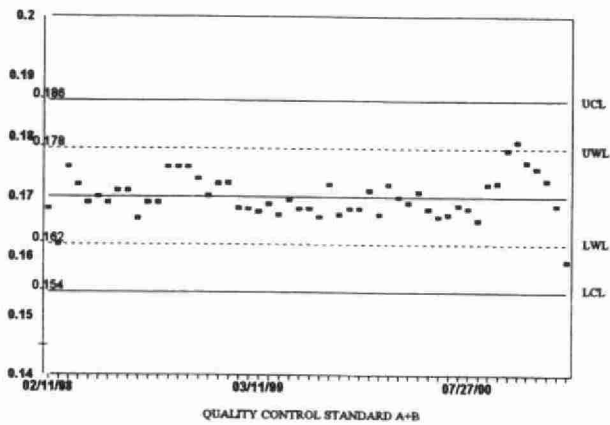
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
105	0 - 0.020	0.0005	14.9
3	0.021 - 0.040	0.0041	13.2
12	0.041 - 0.100	0.0030	4.6
4	0.101 - 0.200	0.0014	0.9
124	Overall	0.0012	

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 11/02/98 TO 17/12/01

Analytical Range: to 0.2 mg/L as CN



CYANIDE, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN^- Solid: $\mu\text{g/g}$ as CN^-
LIMS Product Code	CN3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Soil, Sediment, Vegetation, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Total cyanides include free, simple (HCN , KCN) and weakly dissociable cyanides ($\text{Ni}(\text{CN})_4$) as well as those complexed cyanides that decompose to form free cyanides that distill out as HCN in an acidic environment. The automated determination of total cyanide exposes the sample to ultraviolet radiation to break down organic metallic and alkali-complexed cyanide compounds to free cyanide. The distillation step isolates HCN under specific acidic conditions. The sequential combination of UV digestion plus distillation yields the measurement of "total cyanide". Cyanide is measured colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system from an autosampler.

Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours, then centrifuged. The supernatant is then decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as $\mu\text{g/g}$ wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm.
Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3 down to the nearest W	Current W value: 0.001 mg/L 0.01 $\mu\text{g/g}$	Current T value: 0.005mg/L 0.05 $\mu\text{g/g}$
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CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 17/01/01 TO 20/12/01

Analytical Range: to 0.2 mg/L as CN

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	30	0.15	0.1543	0.0043	0.0029
B:	30	0.02	0.0204	0.0004	0.0005
A+B:		0.17	0.1746	0.0047	0.0031
A-B:		0.13	0.1339	0.0039	0.0028

s.d.(AB)

S(between runs): 0.0021

Sw(within run): 0.0020

S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.154 - 0.186 for A+B
0.118 - 0.142 for A-B

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	30	0.10	0.0863	-0.0137	0.0096
FeCN:	30	0.10	0.0914	-0.0086	0.0098
CLP Soil:(0.2g)	24	44.70	46.8959	2.1959	3.2560
(0.1g)	20	44.70	53.1080	8.4080	1.9214

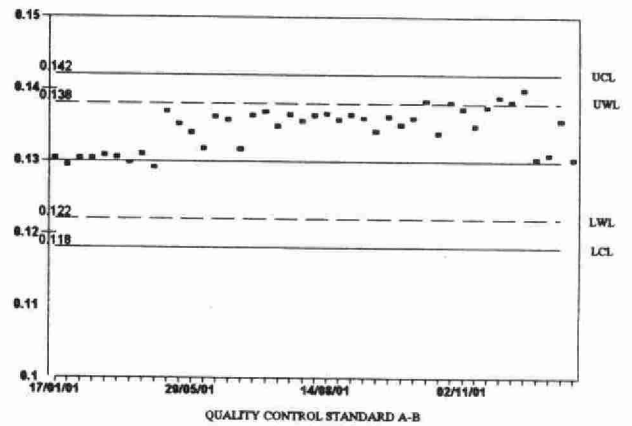
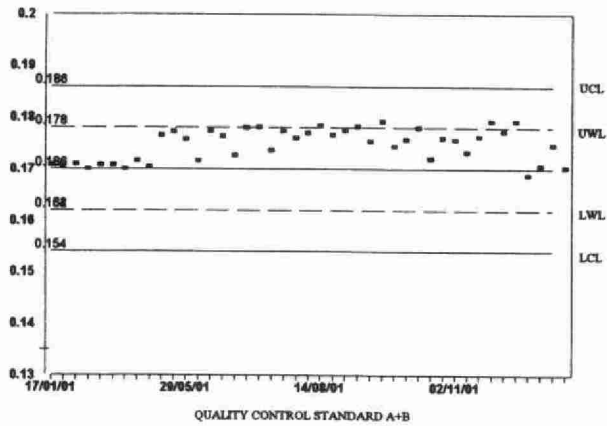
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
57	0 - 0.020	0.0184	2143.9
5	0.021 - 0.040	0.0689	125.2
6	0.041 - 0.100	0.0248	29.4
5	0.101 - 0.200	0.0150	11.0
75	Overall	0.0256	

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 17/01/01 TO 20/12/01

Analytical Range: to 0.2 mg/L as CN



FLUORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	October 2001
Method Reference No	E3172	Reporting Unit	mg/L as F
LIMS Product Code	F3172, ANION3172	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water, Raw Sewage, Sediment, Dried Sludge, Unknown Material, Soil		

SAMPLING:

Quantity Required	50 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Fluoride is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.0010 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detector. The concentration of fluoride in mg/L as F⁻ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for the automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

NOTES:

This method replaced E3369, October 2001.

Method E3369 calibration control values were used to establish initial control limits for the present method.

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 04/10/01 TO 22/12/01

Analytical Range: to 2.0 mg/L as F

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	15	1.60	1.60	0.00	0.0106
B:	15	0.80	0.81	0.01	0.0069
C:	15	0.16	0.17	0.01	0.0097
A+B:		2.40	2.41	0.01	0.0151
A-B:		0.80	0.80	0.00	0.0096
B+C:		0.96	0.97	0.01	0.0090
B-C:		0.64	0.64	0.00	0.0142

s.d.(AB) S(between runs):0.0096

Sw(within run): 0.0068

S/Sw: 1.4

s.d.(BC) S(between runs):0.0142

Sw(within run): 0.1000

S/Sw: 1.4

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.362	-	2.4384	for	A+B
0.771	-	0.8288	for	A-B
0.903	-	1.0167	for	B+C
0.598	-	0.6825	for	B-C

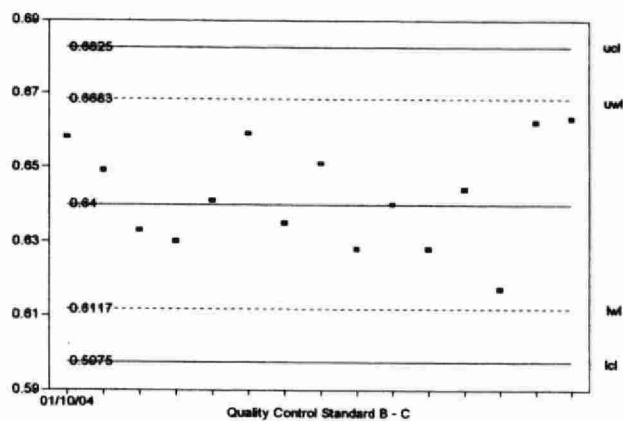
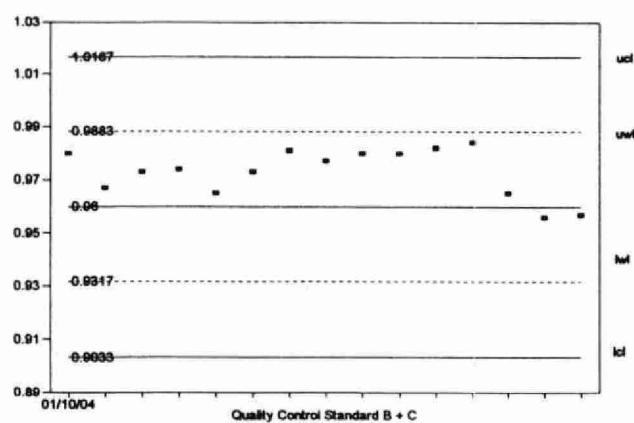
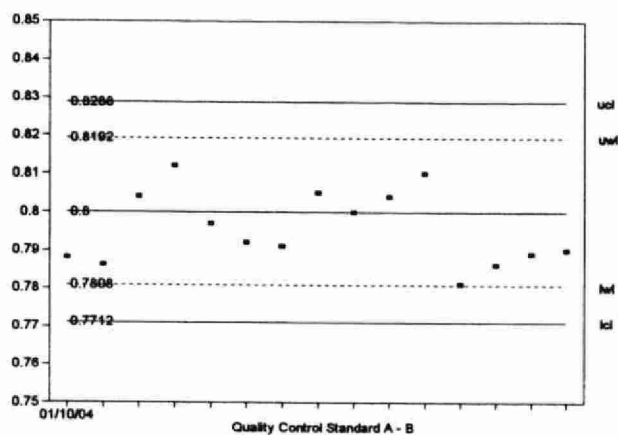
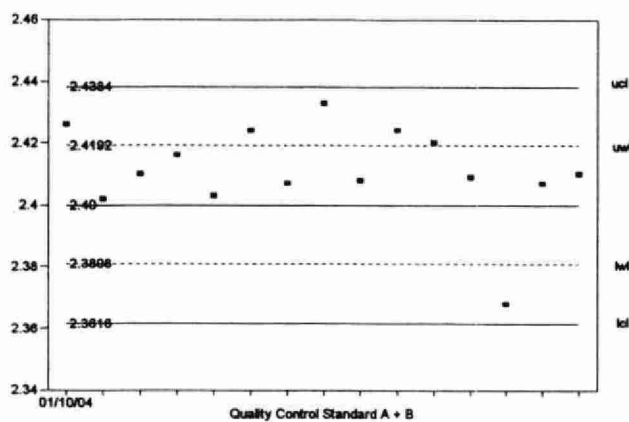
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
35	0.00 - 0.20	0.0116	18.4
4	0.21 - 0.40	0.0081	3.0
4	0.41 - 1.00	0.0032	0.6
2	1.01 - 2.00	n.a	n.a
45	Overall	0.0128	

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 04/10/01 TO 22/12/01

Analytical Range: to 2.0 mg/L as F



FLUORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	before '74
Method Reference No	E3369	Reporting Unit	mg/L as F
LIMS Product Code	F3369	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Using an automated flow system the sample is distilled in the presence of sulphuric acid at 160°C; the distillate is then reacted (in an acetic acid-acetate buffer media) with Alizarin Fluorine Blue and lanthanum nitrate to form a ternary Alizarin Blue-lanthanide-fluoride complex.

Approximate absorbance: 0.8 at the full scale level.

INSTRUMENTATION:

Modular continuous flow colourimetric system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 630 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA
Drift	BL every 10 samples; standard every 20 samples

NOTES:

The HP data capture/processing was replaced by Labtronics in November 1999.

Feb 1998. The Nitrite test was discontinued at E3369 and made available at E3364 and E3366. The LIMS product code changed from FNOT3369 to F3369.

The method was discontinued in October, 2001. Fluoride is now done by ion chromatography (E3172).

FLUORIDE (E3369)

QUALITY CONTROL DATA FROM 04/01/01 TO 02/10/01

Analytical Range: to 2.0 mg/L as F

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	41	1.6	1.609	0.009	0.0273
B:	41	0.8	0.796	-0.004	0.0166
C:	41	0.16	0.159	-0.001	0.0119
A+B:		2.4	2.405	0.005	0.0359
A-B:		0.8	0.813	0.013	0.0274
B+C:		0.96	0.955	-0.005	0.0242
B-C:		0.64	0.636	-0.004	0.0158

s.d.(AB) S(between runs):0.0226

Sw(within run): 0.0194

S/Sw: 1.2

s.d.(BC) S(between runs):0.0114

Sw(within run): 0.0112

S/Sw: 1.3

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.302	-	2.498	for	A+B
0.726	-	0.874	for	A-B
0.91	-	1.01	for	B+C
0.59	-	0.69	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
70	0.00 - 0.20	0.0175	15.9
14	0.21 - 0.40	0.0140	5.9
25	0.41 - 1.00	0.0190	2.7
6	1.01 - 2.00	0.0129	0.8
115	Overall	0.0173	

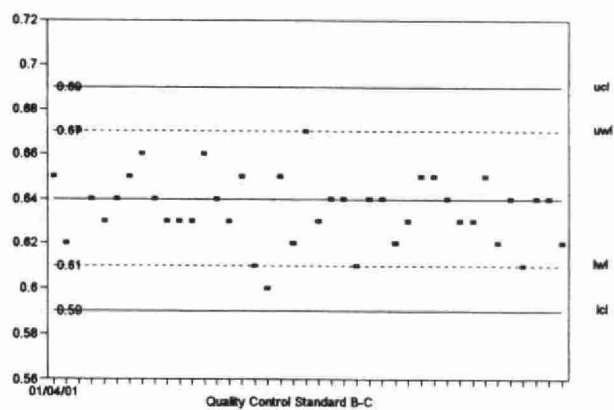
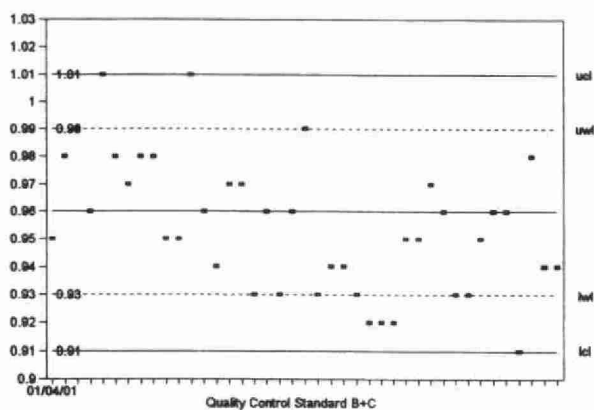
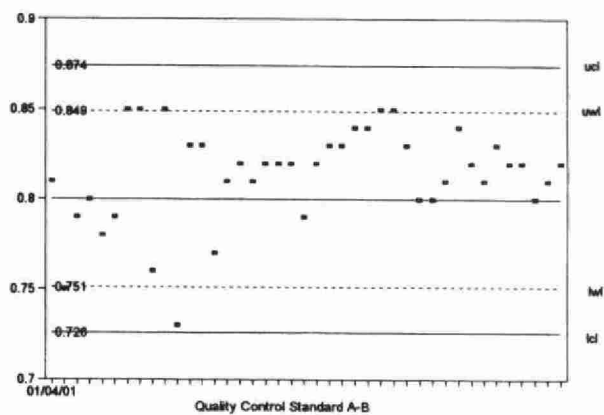
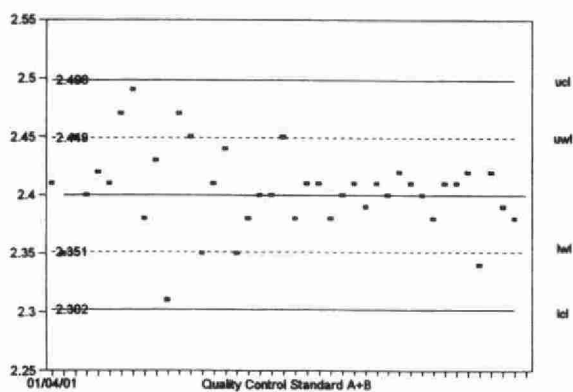
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	41	0.0107	0.0271

FLUORIDE (E3369)

QUALITY CONTROL DATA FROM 04/01/01 TO 02/10/01

Analytical Range: to 2.0 mg/L as F



NITRATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as NO_3
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Nitrate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of nitrate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as NO_3 .

Chloride and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:
6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2
Drift	Duplicate plus 2 standards approximately every 20 samples

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of NO_3 in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

NITRATE (E3004)

QUALITY CONTROL DATA FOR 2001

Analytical Range: to 28.61 $\mu\text{g}/\text{m}^3$ as NO_3

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
47	0.00 - 2.86	0.057	8.1
12	2.89 - 7.15	0.127	2.7
5	7.18 - 14.31	0.127	1.0
1	14.33 - 24.90	N.A.	N.A.
65	Overall	0.087	

NITRILOTRIACETIC ACID

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	17/04/98
Method Reference No.	E3406	Reporting Unit	mg/L as NTA
LIMS Product Code	NTA3406	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitritotriacetic Acid is separated from other anions in the samples by automated suppressed gradient ion chromatography. A sodium hydroxide eluent is used with conductivity detection. The concentration of Nitritotriacetic acid in mg/L as NTA is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module .

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	1 standard every 10 samples

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 12/01/01 TO 19/12/01

Analytical Range: to 1.00 mg/L as NTA

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	33	0.80	0.804	0.004	0.0166
B:	33	0.20	0.199	-0.001	0.0128
A+B:		1.00	1.003	0.003	0.0218
A-B:		0.60	0.606	0.006	0.0200

s.d.(AB)

S(between runs): 0.0148

Sw(within run): 0.0141

S/Sw: 1.05

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.95	-	1.05	for	A+B
0.56	-	0.64	for	A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
37	0.00 - 0.10	0.0079	8.3
40	0.10 - 0.20	0.0081	6.8
0	0.20 - 0.50	N.A.	N.A.
0	0.50 - 1.00	N.A.	N.A.
77	Overall		

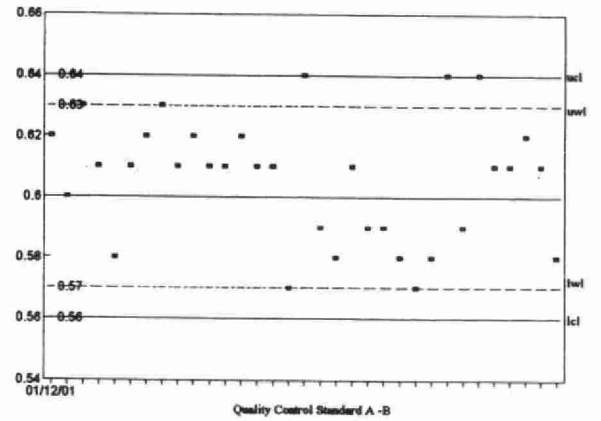
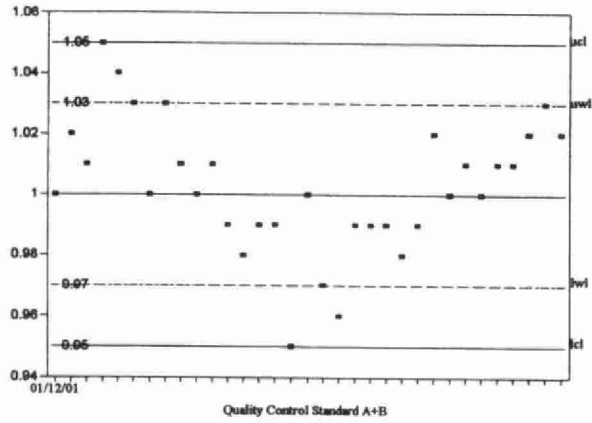
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	33	0	0

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 12/01/01 TO 19/12/01

Analytical Range: to 1.00 mg/L as NTA



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P. Wilson
Sample Type/Matrix	Dried Sludge, Sediment, Soil, Vegetation, Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream, which differs from the colour formation stream by replacement of the catalyst with an equal flow of water, is employed to suppress sample matrix effects.

Approximate absorbance: 0.5 at the full scale level.

Nitrate plus nitrite, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: Two 38°C heating baths (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.010
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard, and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

NITROGEN, AMMONIA PLUS AMMONIUM (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 2.00 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	104	1.60	1.596	-0.004	0.0104
B:	104	0.800	0.797	-0.003	0.0085
C:	104	0.160	0.161	0.001	0.0056
A+B:		2.40	2.393	-0.007	0.0161
A-B:		0.800	0.798	-0.002	0.0101
B+C:		0.960	0.958	-0.002	0.0111
B-C:		0.640	0.637	-0.003	0.0092

s.d.(AB) S(between runs):0.0095 Sw(within run): 0.0071 S/Sw: 1.3
 s.d.(BC) S(between runs):0.0072 Sw(within run): 0.0065 S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.353 - 2.447 for A+B
 0.765 - 0.835 for A-B
 0.931 - 0.989 for B+C
 0.618 - 0.662 for B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
262	0.000 - 0.200	0.0037	12.4
12	0.201 - 0.400	0.0088	3.3
9	0.401 - 1.00	0.0072	1.3
0	1.01 - 2.00	N.A.	N.A.
283	Overall	0.0042	

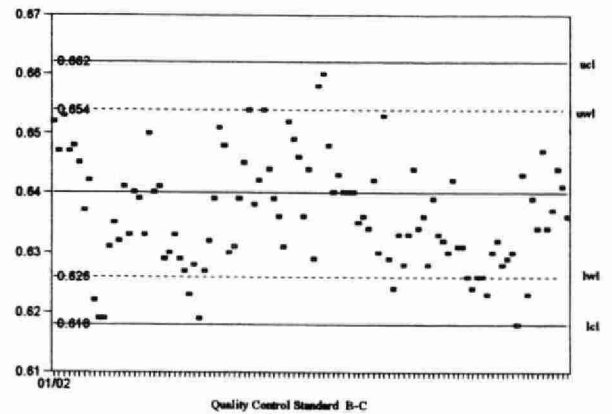
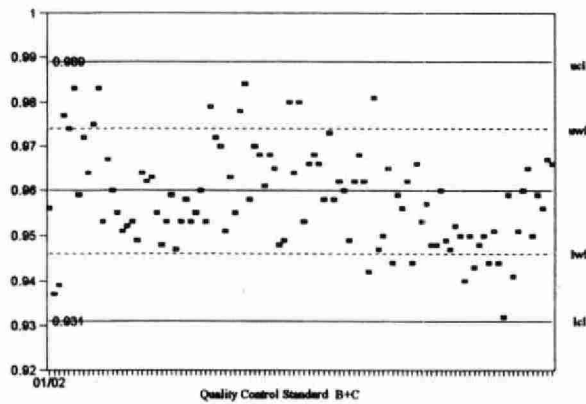
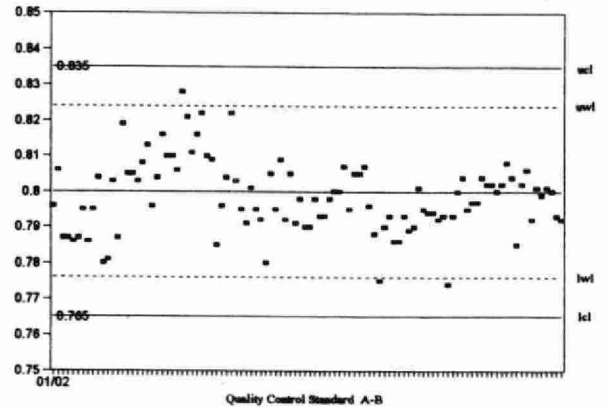
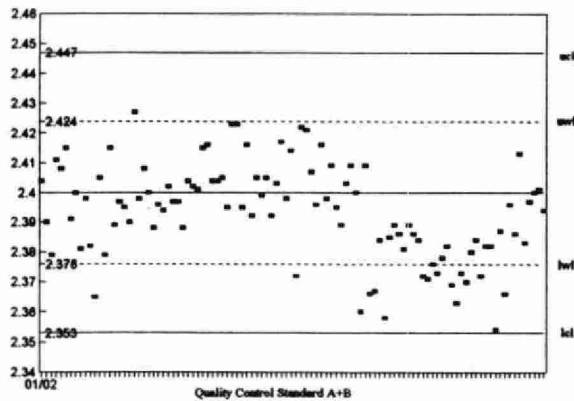
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	104	0.0002	0.0037

NITROGEN, AMMONIA PLUS AMMONIUM (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 2.00 mg/L as N



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/77
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Drinking Water, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.7 at the full scale level.

Reactive orthophosphate, nitrogen-nitrite and nitrogen-nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus one 38°C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

NITROGEN, AMMONIA PLUS AMMONIUM (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	92	40.0	39.848	-0.152	0.2939
B:	92	20.0	19.969	-0.031	0.1698
C:	92	4.00	3.927	-0.073	0.1098
A+B:		60.0	59.817	-0.183	0.3659
A-B:		20.0	19.878	-0.122	0.3108
B+C:		24.0	23.896	-0.104	0.2323
B-C:		16.0	16.043	0.043	0.1668

s.d.(AB) S(between runs):0.24
s.d.(BC) S(between runs):0.14

Sw(within run): 0.14
Sw(within run): 0.12

S/Sw: 1.1
S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

58.76	-	61.24	for	A+B
19.07	-	20.93	for	A-B
23.34	-	24.66	for	B+C
15.50	-	16.50	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
198	0.00 - 5.00	0.0325	9.8
23	5.10 - 10.0	0.1572	2.1
26	10.1 - 25.0	0.1875	1.1
4	25.1 - 50.0	0.2688	0.8
251	Overall	0.0890	

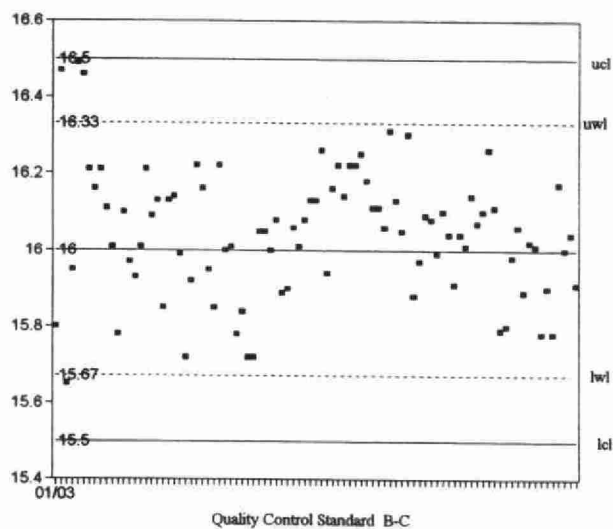
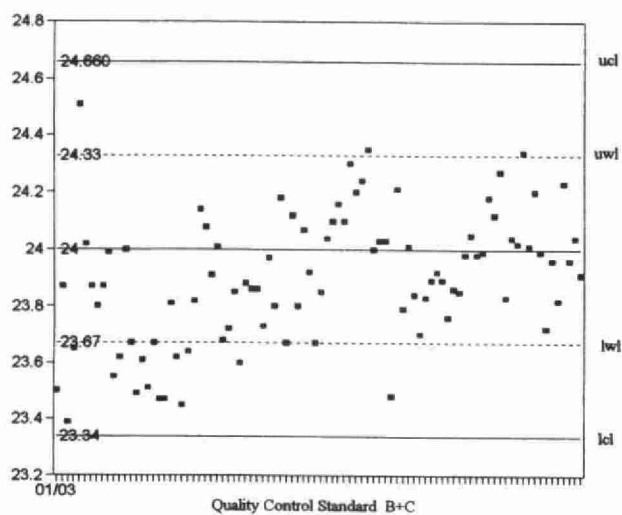
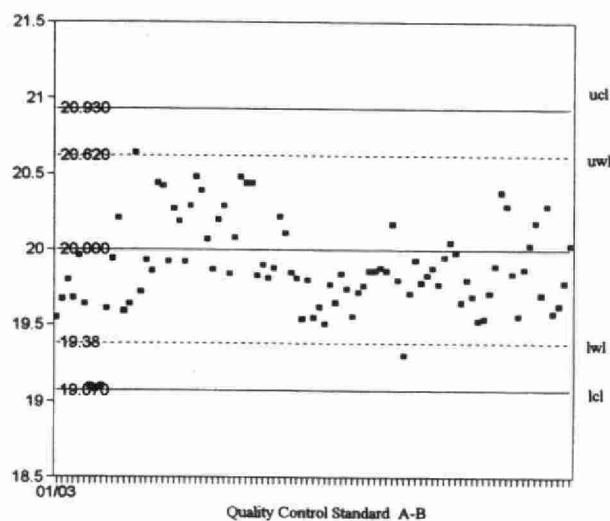
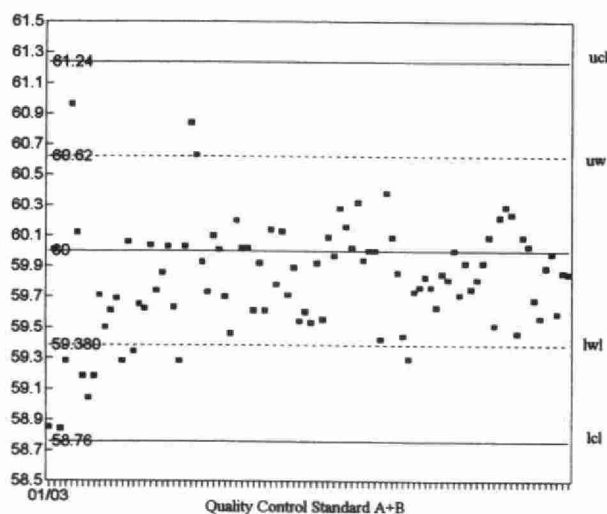
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	92	-0.0072	0.0378

NITROGEN, AMMONIA PLUS AMMONIUM (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P. Wilson
Sample Type/Matrix	Dried Sludge, Sediment, Soil, Vegetation, Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 37°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay), ion exchange column. Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES: The HP data capture / processing system was replaced by Labtronics in August 1999.

NITROGEN, NITRATE PLUS NITRITE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 5.00 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	MeanBias	Standard Deviation (1)
A:	107	4.00	3.999	-0.001	0.0276
B:	107	2.00	1.997	-0.003	0.0210
C:	107	0.40	0.391	-0.009	0.0086
A+B:		6.00	5.996	-0.004	0.0396
A-B:		2.00	2.002	0.002	0.0290
B+C:		2.40	2.388	-0.002	0.0263
B-C:		1.60	1.605	0.005	0.0186

s.d.(AB) S(between runs):0.0205

s.d.(BC) S(between runs):0.0132

Sw(within run): 0.0245

Sw(within run): 0.0161

S/Sw: 1.2

S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

5.868	-	6.132	for	A+B
1.901	-	2.099	for	A-B
2.328	-	2.472	for	B+C
1.546	-	1.654	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
190	0 - 0.500	0.0051	2.9
24	0.501 - 1.00	0.0099	1.3
38	1.01 - 2.50	0.0176	1.0
15	2.51 - 5.00	0.0318	0.9
267	Overall	0.1302	

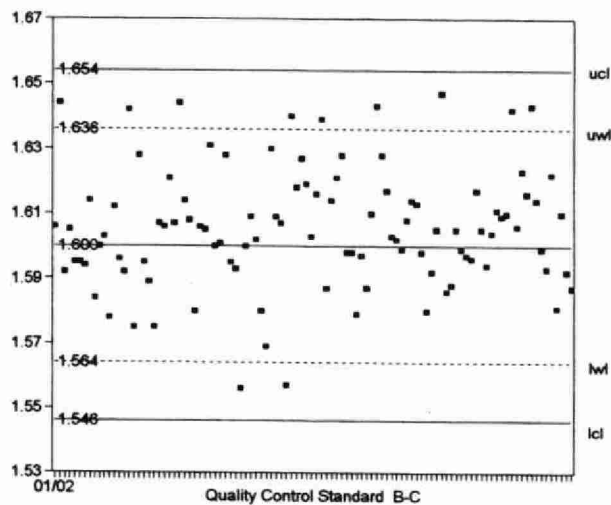
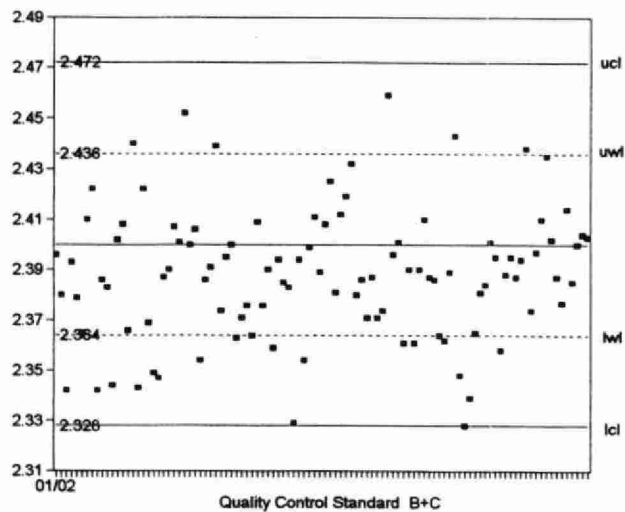
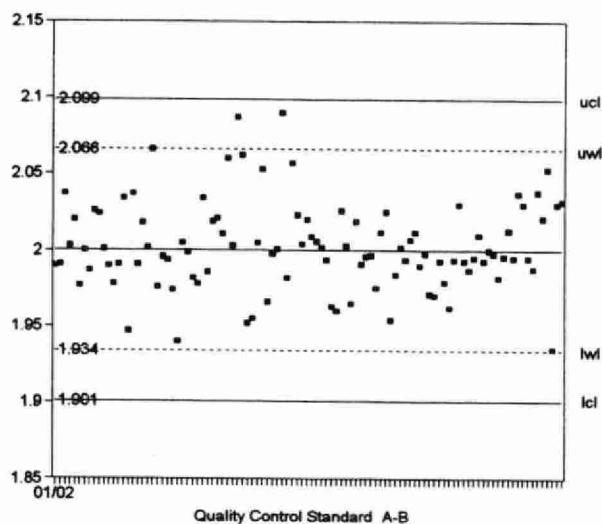
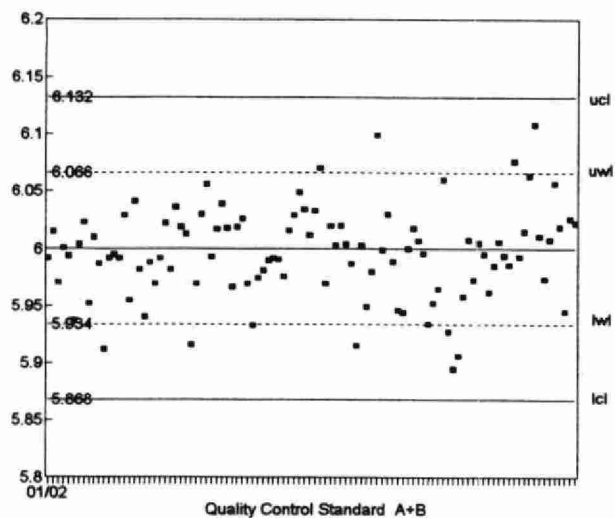
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	104	-0.0015	0.003

NITROGEN, NITRATE PLUS NITRITE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 5.00 mg/L as N



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Drinking Water, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 38°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.7 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive phosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Two analytical ranges are obtained from the output of the colourimeter. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:The HP capture / processing system was replaced by Labtronics in October 1999.

NITROGEN, NITRATE PLUS NITRITE (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	92	40.0	39.880	-0.120	0.3203
B:	92	20.0	20.020	0.020	0.2038
C:	92	4.00	4.011	0.011	0.1064
A+B:		60.0	59.900	-0.100	0.4174
A-B:		20.0	19.860	-0.140	0.3377
B+C:		24.0	24.031	0.031	0.2482
B-C:		16.0	16.009	0.009	0.2101

s.d.(AB)

S(between runs):0.27

Sw(within run):0.24

S/SW:1.1

s.d.(BC)

S(between runs):0.16

Sw(within run):0.15

S/Sw:1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

58.66	-	61.34	for	A+B
18.99	-	21.01	for	A-B
23.28	-	24.72	for	B+C
15.46	-	16.54	for	B-C

DUPLICATES:

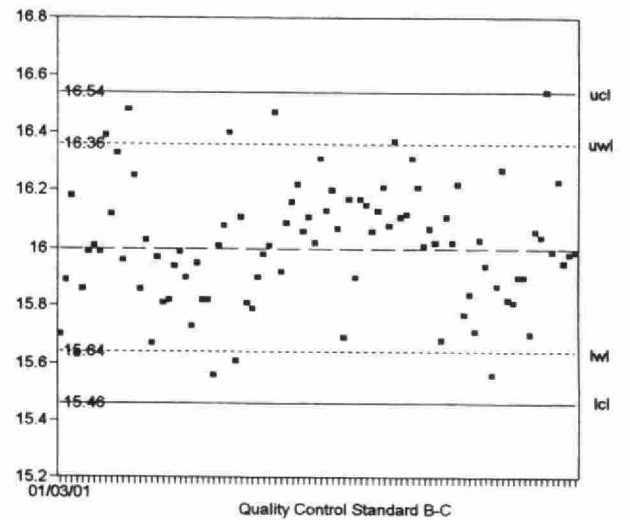
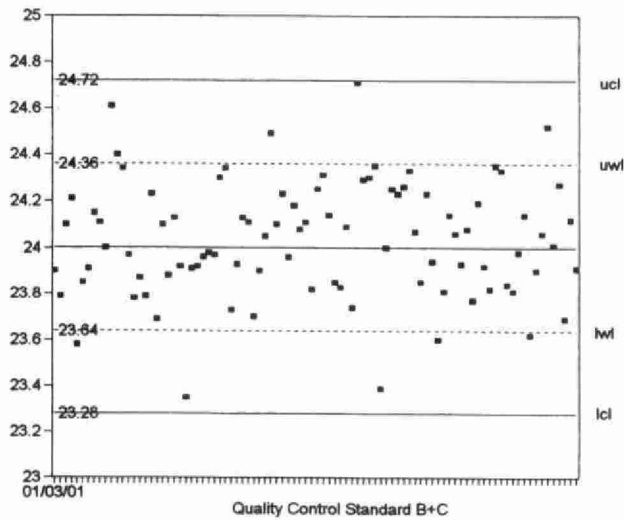
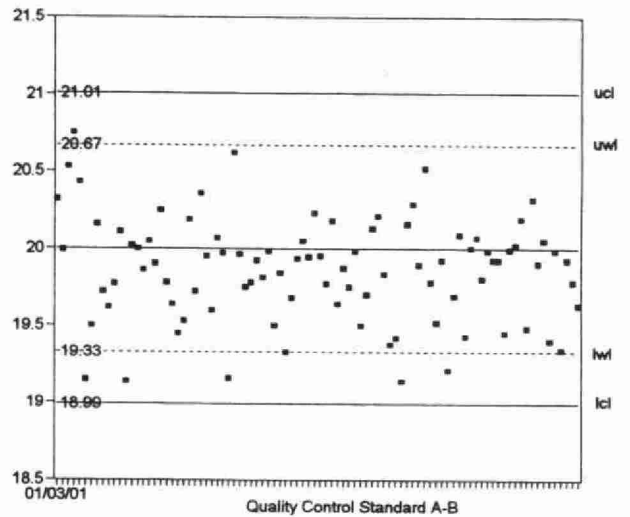
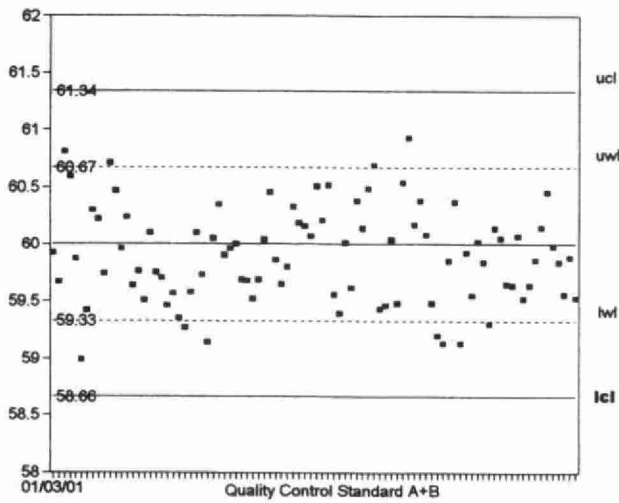
n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
157	0.000 - 5.00	0.0378	4.5
37	5.01 - 10.0	0.0913	1.2
34	10.1 - 25.0	0.2316	1.6
7	25.1 - 50.0	0.2043	0.6
235	Overall	0.1064	

OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	92	-0.0184	0.0232

NITROGEN, NITRATE PLUS NITRITE (E3366)
QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P. Wilson
Sample Type/Matrix	Dried Sludge, Sediment, Soil, Vegetation, Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001	Current T value: 0.005
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard and BL after every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

NITROGEN, NITRITE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 0.200 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	104	0.160	0.1601	0.0001	0.0012
B:	104	0.080	0.0800	0.0000	0.0011
C:	104	0.016	0.0160	0.0000	0.0010
A+B:		0.240	0.2401	0.0001	0.0018
A-B:		0.080	0.0801	0.0001	0.0014
B+C:		0.096	0.0960	0.0000	0.0015
B-C:		0.064	0.0640	0.0000	0.0014

s.d.(AB) S(between runs):0.0012
s.d.(BC) S(between runs):0.0010

Sw(within run): 0.0010
Sw(within run): 0.0010

S/Sw: 1.1
S/Sw: 1.0

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.234 - 0.246 for A+B
0.076 - 0.084 for A-B
0.092 - 0.100 for B+C
0.061 - 0.067 for B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
219	0.000 - 0.020	0.0010	23.6
32	0.021 - 0.040	0.0014	5.0
24	0.041 - 0.100	0.0023	3.6
9	0.101 - 0.200	0.0029	2.0
284	Overall	0.0013	

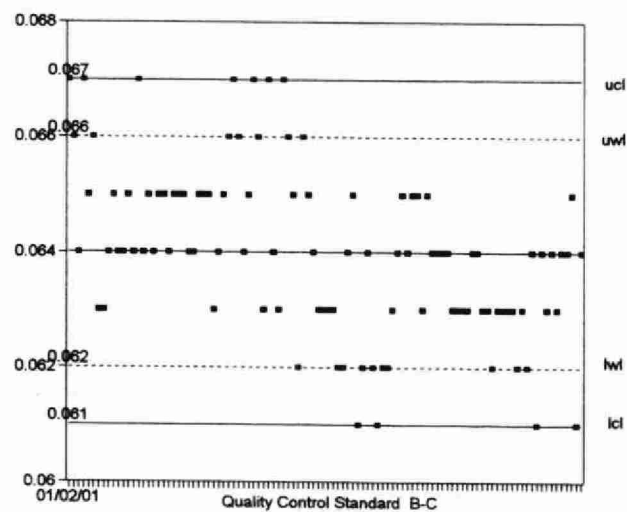
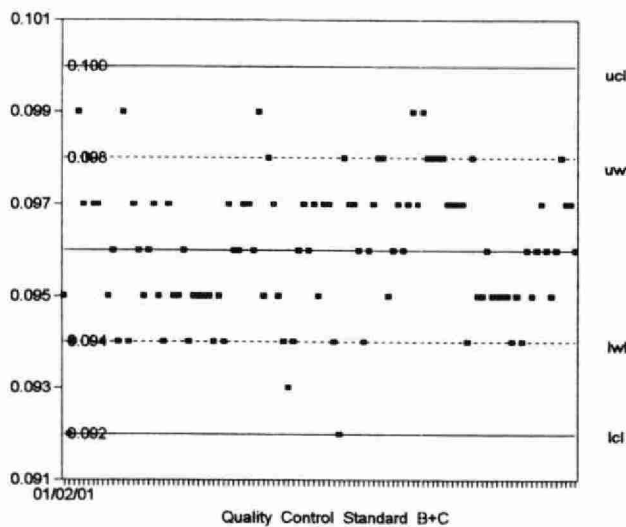
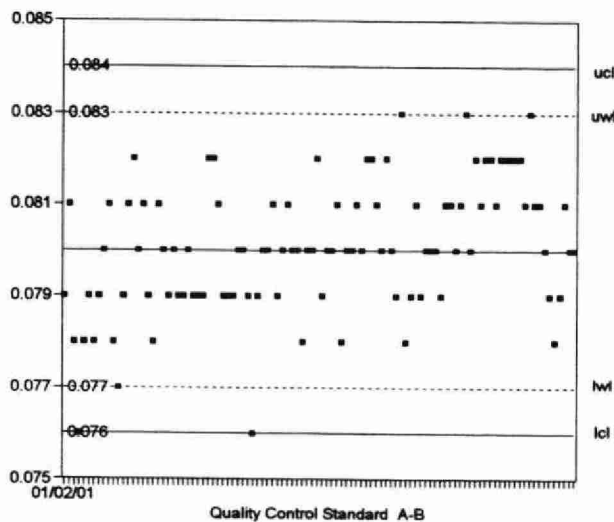
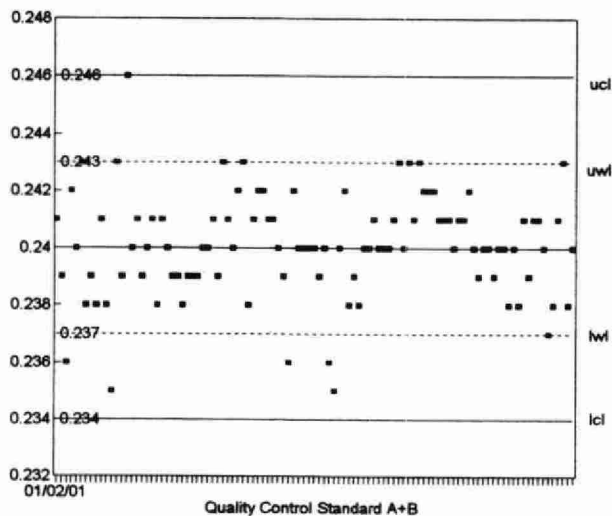
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	104	0.00023	0.00084

NITROGEN, NITRITE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 0.200 mg/L as N



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Drinking Water, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.3 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

NITROGEN, NITRITE (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 2.00 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	92	1.60	1.5981	-0.0019	0.0126
B:	92	0.80	0.7949	-0.0051	0.0072
C:	92	0.160	0.1593	-0.0007	0.0046
A+B:		2.40	2.3930	-0.0070	0.0158
A-B:		0.80	0.8032	0.0032	0.0131
B+C:		0.960	0.9542	-0.0058	0.0091
B-C:		0.640	0.6355	-0.0045	0.0080

s.d.(AB)	S(between runs):0.0103	Sw(within run):	0.0093	S/Sw: 1.1
s.d.(BC)	S(between runs):0.0061	Sw(within run):	0.0057	S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.352	-	2.448	for	A+B
0.764	-	0.836	for	A-B
0.936	-	0.984	for	B+C
0.622	-	0.658	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
220	0.000 - 0.200	0.0037	14.6
10	0.201 - 0.400	0.0122	4.3
14	0.401 - 1.00	0.0277	4.2
8	1.01 - 2.00	0.0226	1.5
252	Overall	0.0088	

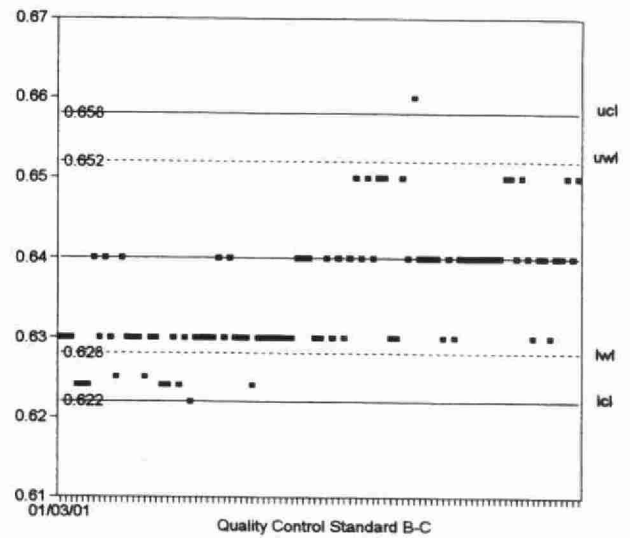
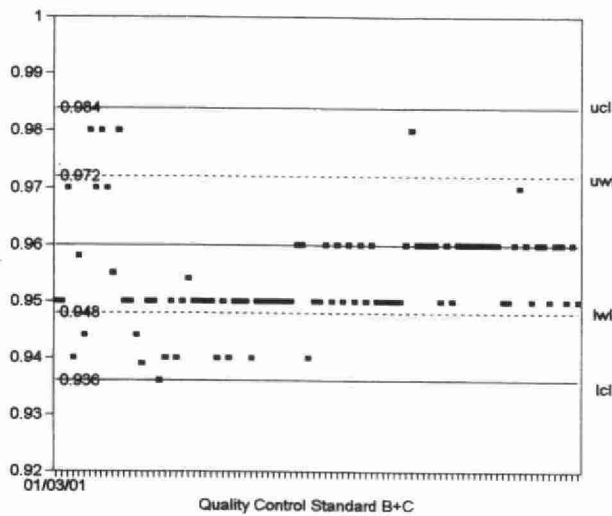
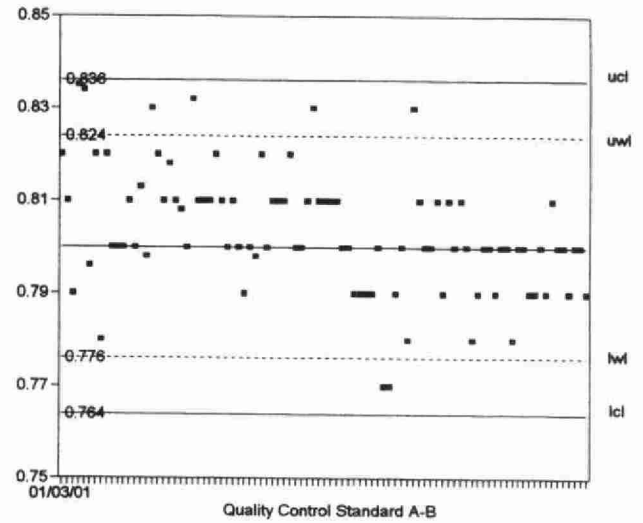
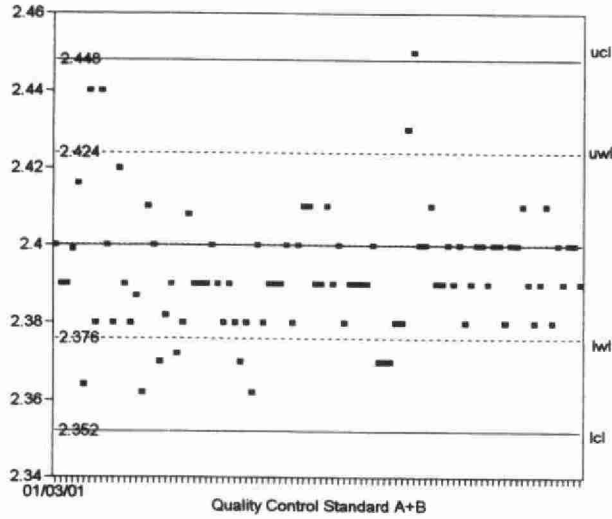
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	93	-0.0024	0.0054

NITROGEN, NITRITE (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 2.00 mg/L as N



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as N
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia and organic nitrogen compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate .

Basic automated modular continuous flow system : 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture, and processing via a microcomputer system.

REPORTING:

Maximum Significant Figures: 3 decimal places	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite B-Soil/sediment, plus QC Soils/Sediment (RS92)
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards.

Low Recoveries for the Domestic Sludge SRM 2781 are under investigation.

NITROGEN, TOTAL KJELDAHL (E3116)

QUALITY CONTROL DATA FROM 07/04/01 TO 18/12/01

Analytical Range: to 10 mg/g as N

QUALITY CONTROL:

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
RS92 - In House Soil Composite	252	1.69	1.56	0.1201
RSM-2781 -Domestic Sludge Certified	53	42.2	42.24	4.3508

The run is accepted if the control values obtained lie within the ranges:

1.39 - 1.99 for RS92
29.1 - 55.2 for RSM-2781

Recovery Standards

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
R1	25	5.25	5.25	0.1592
R2	25	1.75	1.74	0.0797

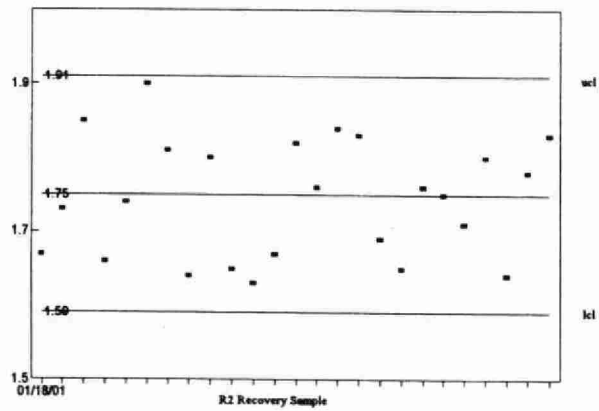
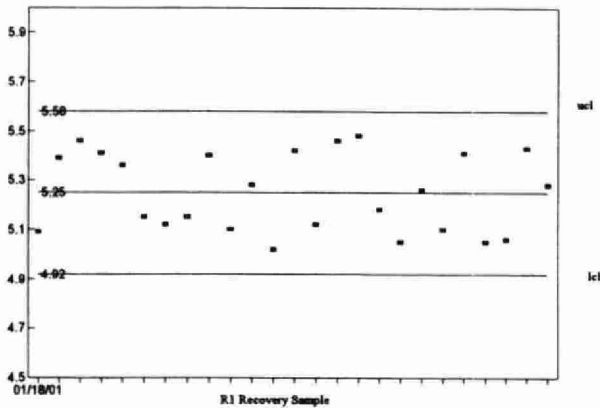
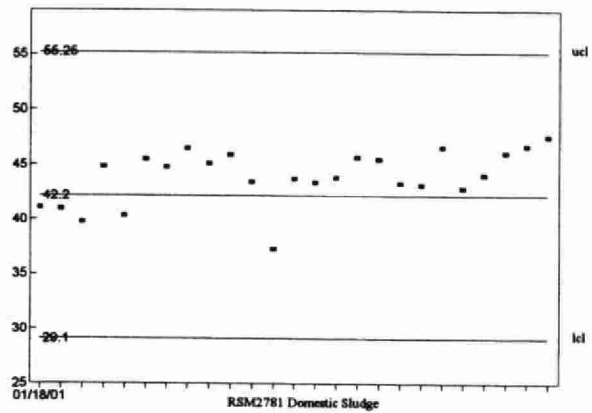
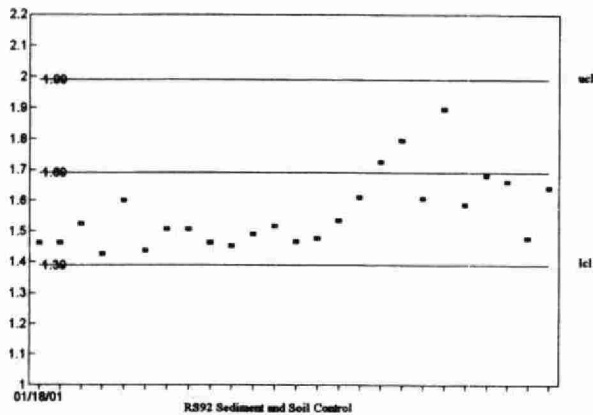
DUPLICATES: (Sediment/Soils)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
31	0.00 - 2.00	0.1190	11.2
5	2.01 - 4.00	0.1471	5.6
8	4.01 - 10.0	0.6970	9.6
0	10.1 - 20.0	N.A.	N.A.
44	Overall	0.3103	

NITROGEN, TOTAL KJELDAHL (E3116)

QUALITY CONTROL DATA FROM 07/04/01 TO 18/12/01

Analytical Range: to 10 mg/g as N



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3118	Reporting Unit	mg/g as N
LIMS Product Code	TNP3118	Supervisor	P. Wilson
Sample Type/Matrix	Vegetation, Moss Bag		

SAMPLING:

Quantity Required	0.02 to 0.04 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia and organic nitrogen compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate.

Basic automated modular continuous flow system : 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture and processing via a microcomputer system.

REPORTING:

Maximum Significant Figures: 3 decimal places	Current W value: 0.20	Current T value: 1.00
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite A-VEG, plus QC VEG (Pine Needles)
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards.

NITROGEN, TOTAL KJELDAHL (E3118)

QUALITY CONTROL DATA FROM 07/04/01 TO 18/12/01

Analytical Range: to 10 mg/g as N

QUALITY CONTROL:

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
Pine Needles	14	12.1	11.46	0.6511

The run is accepted if the control values obtained lie within the ranges:
10.3 - 13.9 for Pine Needles

Recovery Standards

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
R1	25	5.25	5.25	0.1592
R2	25	1.75	1.74	0.0797

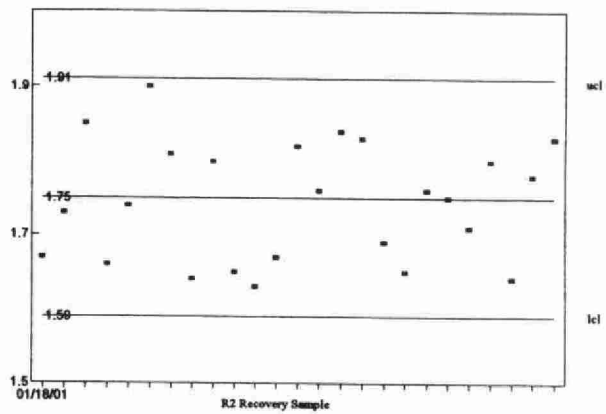
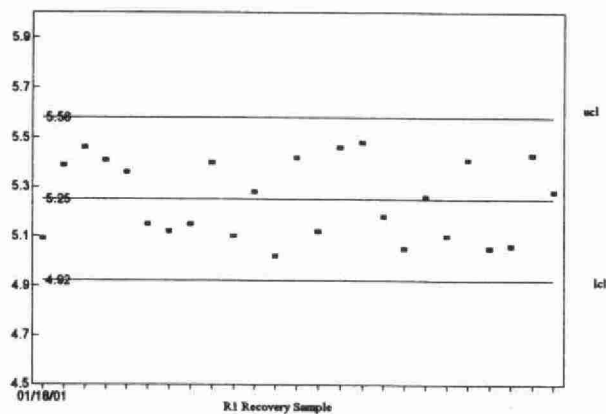
DUPLICATES: (VEGITATION)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
0	0.00 - 10.0	N.A.	N.A.
5	10.1 - 20.0	0.8191	4.3
10	20.1 - 50.0	0.7934	2.7
15	Overall	0.8021	3.1

NITROGEN, TOTAL KJELDAHL (E3118)

QUALITY CONTROL DATA FROM 07/04/01 TO 18/12/01

Analytical Range : to 10 mg/g as N



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3367	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Ground Water , Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia and organic nitrogen compounds are determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.3 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 5.0 cm. light path at 630 nm.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.1
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by Labtronics in May 1999.

NITROGEN, TOTAL KJELDAHL (E3367)

QUALITY CONTROL DATA FROM 04/01/01 TO 24/12/01

Analytical Range: to 2.00 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	103	1.60	1.6025	0.0025	0.0118
B:	103	0.800	0.8004	0.0004	0.0084
C:	103	0.160	0.1587	-0.0013	0.0102
A+B:		2.40	2.4029	0.0029	0.0174
A-B:		0.800	0.8021	0.0021	0.0109
B+C:		0.960	0.9591	-0.0009	0.0164
B-C:		0.640	0.6417	0.0017	0.0091

s.d.(AB)	S(between runs):	0.0103	Sw(within run):	0.0077	S/Sw: 1.3
s.d.(BC)	S(between runs):	0.0094	Sw(within run):	0.0064	S/Sw: 1.5

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.32	-	2.48	for A+B
0.740	-	0.860	for A-B
0.913	-	1.007	for B+C
0.605	-	0.675	for B-C

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
103	1.40	1.3904	0.0399
103	0.840	0.8352	0.0170
103	0.280	0.2830	0.0119

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
58	0.000 - 0.200	0.0248	19.3
134	0.201 - 0.400	0.0394	13.1
103	0.401 - 1.00	0.1063	17.6
10	1.01 - 2.00	0.1075	9.1
305	Overall	0.0707	

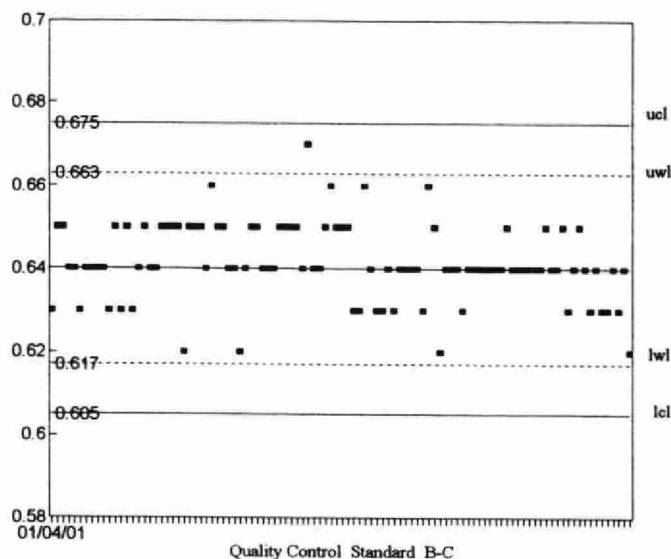
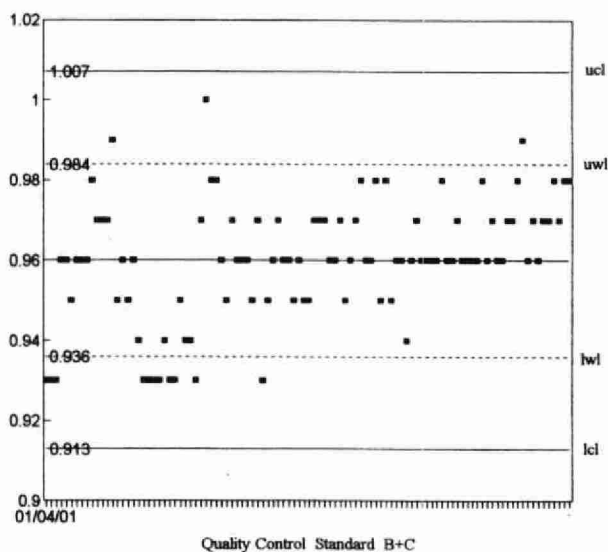
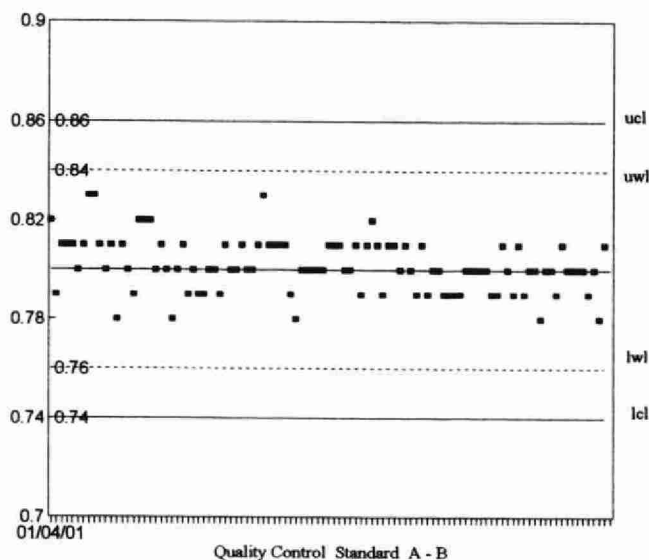
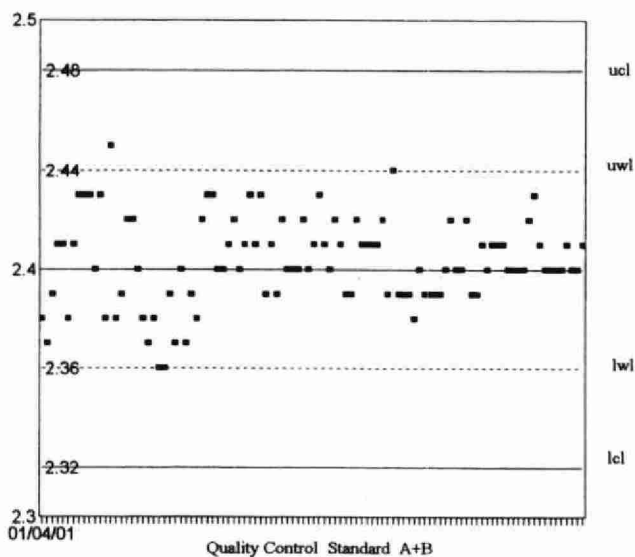
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	103	0.0030	0.0138
Digested Blank	103	0.0070	0.0115

NITROGEN, TOTAL KJELDAHL (E3367)

QUALITY CONTROL DATA FROM 04/01/01 TO 24/12/01

Analytical Range: to 2.00 mg/L as N



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3368	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Drinking Water, Effluent, Ground Water, Process Water, Leachate, Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia and organic nitrogen compounds are determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 1.1 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL every 10 samples; undigested standard every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by Labtronics in April 1999.

NITROGEN, TOTAL KJELDAHL (E3368)

QUALITY CONTROL DATA FROM 02/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	69	40.0	40.054	0.054	0.2070
B:	69	20.0	20.114	0.114	0.1039
C:	69	4.0	3.934	-0.066	0.0576
A+B:		60.0	60.169	0.169	0.2807
A-B:		20.0	19.940	-0.060	0.1688
B+C:		24.0	24.049	0.049	0.1368
B-C:		16.0	16.179	0.179	0.0977

s.d.(AB) S(between runs): 0.164 Sw(within run): 0.119 S/Sw: 1.4
s.d.(BC) S(between runs): 0.084 Sw(within run): 0.070 S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

59.27 - 60.73 for A+B
19.45 - 20.55 for A-B
23.58 - 24.42 for B+C
15.68 - 16.32 for B-C

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
68	35	34.97	0.6004
68	21	20.97	0.3771
68	7	6.94	0.1347

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
154	0.00 - 5.00	0.1192	11.1
25	5.01 - 10.0	0.1246	1.5
21	10.1 - 25.0	0.3532	2.2
3	25.1 - 50.0	1.4958	3.4
203	Overall	0.2422	

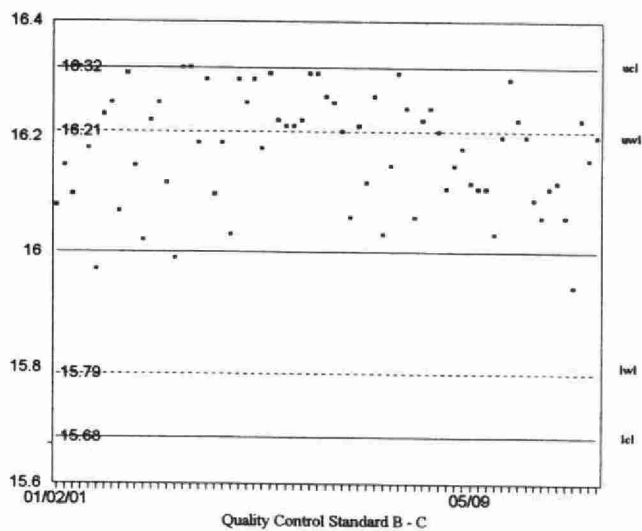
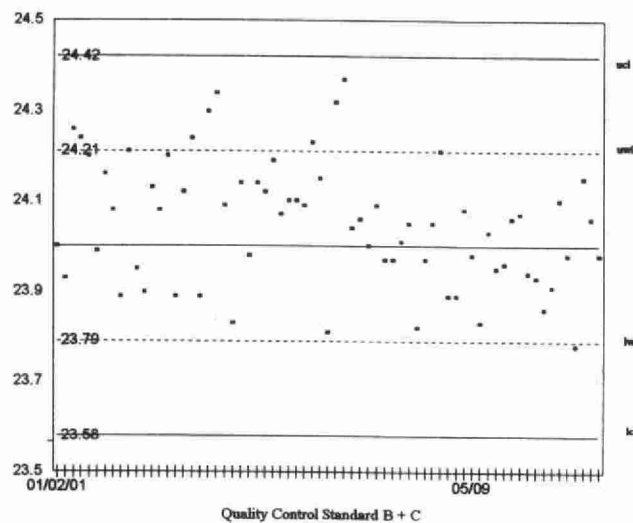
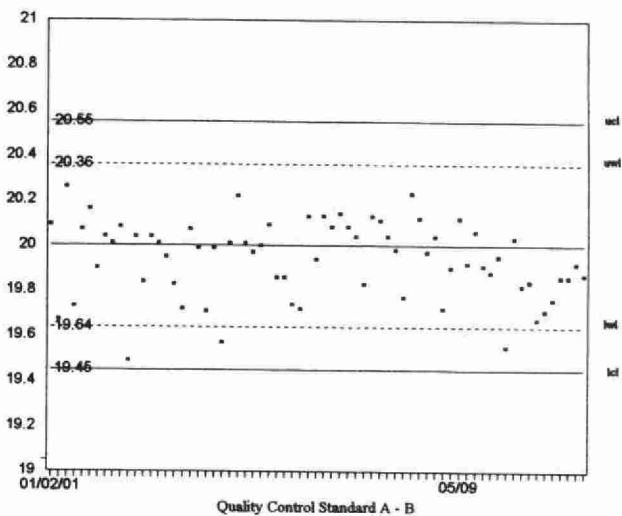
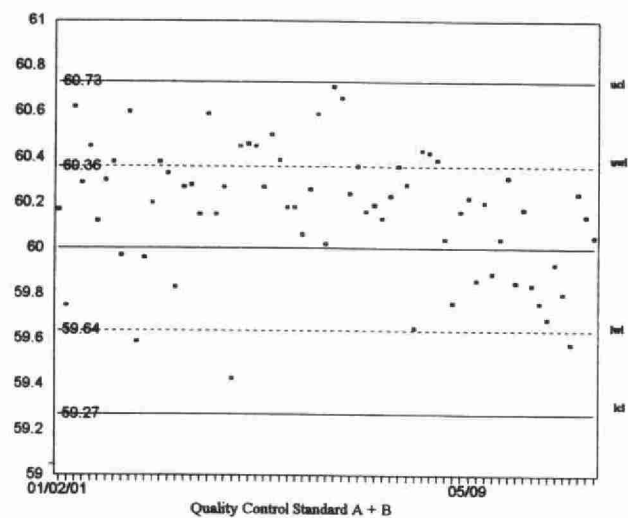
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	69	-0.0288	0.0563
Digested Blank	69	-0.0218	0.0586

NITROGEN, TOTAL KJELDAHL (E3368)

QUALITY CONTROL DATA FROM 02/01/01 TO 28/12/01

Analytical Range: to 50.0 mg/L as N



OXYGEN DEMAND, BIOCHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3182	Reporting Unit	mg/L as O ₂
LIMS Product Code	BOD3182	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Effluent, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	400 mL
Container:	Glass or plastic

SAMPLE PREPARATION:

If necessary sample pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite.

ANALYTICAL PROCEDURE:

Oxygen depletion is measured as the difference in dissolved oxygen (DO) concentration. DO readings are taken prior to sample storage, and also at the end of storage in the dark at 20°C for five days (BOD₅). If necessary, dilutions are made with aerated, nutrient-enriched water to obtain a 25-75% oxygen depletion. If the sample has undergone any of the sample preparation steps listed above or if the sample is an industrial waste, a sewage seed is added. For such samples, calculation of an appropriate seed correction is required.

INSTRUMENTATION:

- YSI Model 59 DO meter (Yellow Springs Instrument Company) with DO probe equipped with stirrer and fitted with a Teflon membrane of 0.5 mil thickness which is permeable to oxygen (1 mil = 0.001 inch).
- Titration equipment for Winkler analysis of dissolved oxygen.
- Incubator (19-21°C); BOD bottles (300 mL)

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION (DO):

The standard is air-saturated reversed osmosis deionized water. The DO content is read from a table (ORBISPHERE LABORATORIES - Pressure temperature dissolved oxygen table) after measuring its temperature and the barometric pressure in the laboratory.

OXYGEN DEMAND, BIOCHEMICAL cont'd

CONTROLS:

Calibration (DO)	2 QC solutions of Pure-DW water which have been partially stripped of DO by flushing with nitrogen. These "solutions", of different but unknown DO, are compared using the Oxygen meter and the Winkler titration procedure. The difference between the values for the two analytical methods is utilized as a slope control for the DO Analyzer.
Recovery (BOD5)*	3 Recovery standards prepared from a combination of Glucose and Glutamic Acid e.g. R1; the expected BOD5 is 67% of the oxygen requirement for complete oxidation.
Drift	Air saturated Pure-DW water after every 24 samples.
Blanks*	Pure-DW water and BOD dilution water

NOTES:

* These solutions are incubated for five days alongside samples.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 08/01/01 TO 27/12/01

Analytical Range: to 9.0 mg/L as O₂ at 20°C

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	102	0.00	0.0113	-0.0113	0.0918
B:	102	0.00	0.0424	-0.0424	0.0867

On any given day the calibration is accepted if the values obtained lie within the ranges:

-0.25 - 0.25

RECOVERIES:

Number of Data	Expected Depletion	Mean Depletion	Standard Deviation (1)
51	2.17	2.08	0.1784
50	4.34	4.24	0.2361
49	6.54	6.36	0.2626

DUPLICATES:

n Data Pairs	Sample Depletion Span	Standard Deviation (2)	Coefficient of variation(%)
47	0.0 - 1.8	0.5270	51.7
80	1.9 - 4.5	0.5602	17.4
38	4.6 - 9.0	0.8469	15.3
165	Overall	0.6297	

OTHER CHECKS:

	n	Mean	Standard Deviation (1)
5 Day Pure-DW Blank	53	0.126	0.1371
5 Day BOD Blank	53	0.027	0.1520

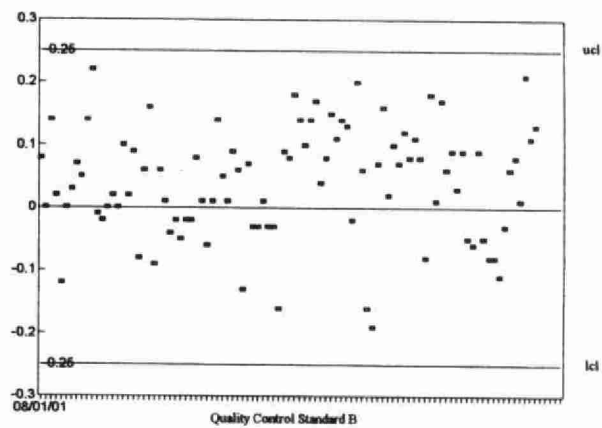
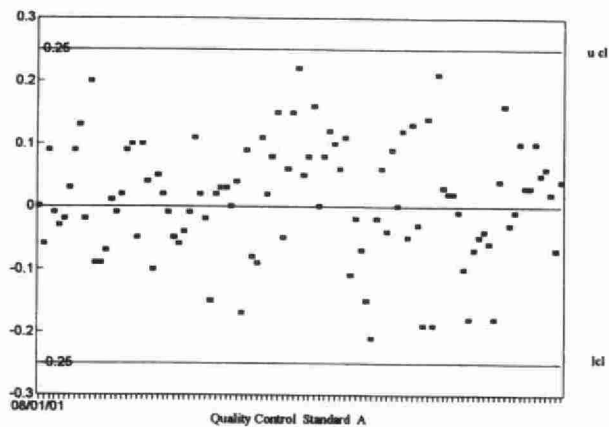
NOTES:

The final concentration of BOD in mg/L as O₂ is determined by the oxygen depletion after 5 days at 20°C multiplied by a dilution and seed correction factor.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 08/01/01 TO 27/12/01

Analytical Range: to 9.0 mg/L as O₂ at 20°C



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3170	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3170	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.05 at the full scale level.

INSTRUMENTATION:

- Culture tubes with Teflon closures; mechanical-convection oven
- Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CALIBRATION:

3 digested BL plus 3 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Undigested BL every 10 samples; standard plus BL at end of run
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (40 mg/L as O ₂) spiked with 50 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week. The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

OXYGEN DEMAND, CHEMICAL (E3170)

QUALITY CONTROL DATA FROM 11/01/01 TO 21/12/01

Analytical Range: to 40.0 mg/L as O₂

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	39	40.0	39.71	-0.29	0.9189
B:	39	10.0	9.89	-0.11	1.2530
A+B:		50.0	49.60	-0.40	1.6297
A-B:		30.0	29.82	-0.18	1.4740

s.d.(AB)

S(between runs): 1.10

Sw(within run): 1.04

S/Sw: 1.05

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

46.3 - 53.7 for A+B
27.2 - 32.8 for A-B

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
39	40	39.25	2.6500
39	10	9.51	1.8835

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
8	0 - 8	0.4446	8.2
33	9 - 20	1.3954	8.9
14	21 - 40	1.5337	6.6
56	Overall	1.3291	

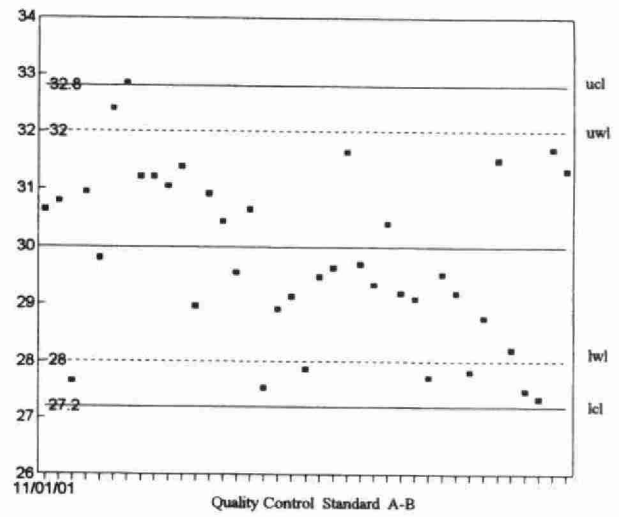
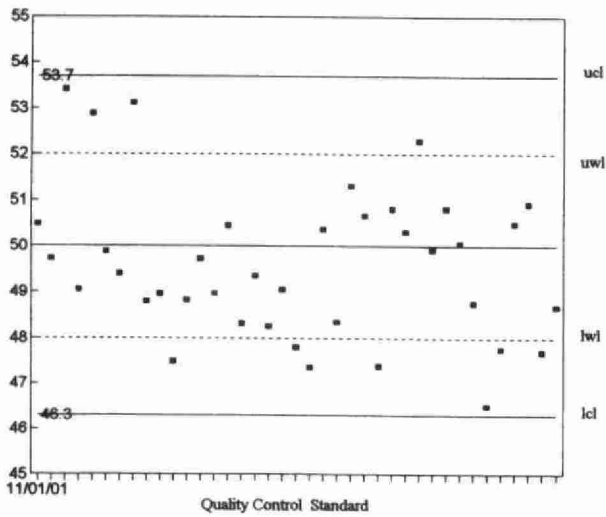
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Chloride Check	38	40.66	2.6192
Digested Blank	39	20.26	6.8219

OXYGEN DEMAND, CHEMICAL (E3170)

QUALITY CONTROL DATA FROM 11/01/01 TO 21/12/01

Analytical Range: to 40.0 mg/L as O₂



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3246	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3246	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Ground Water, Leachate, Effluent, Sludge, Surface Water, Process Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.6 at the full scale level.

INSTRUMENTATION:

-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

2 digested BL plus 4 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Undigested BL every 10 samples; standard plus BL at end of run
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (50 mg/L as O ₂) spiked with 900 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week. The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

OXYGEN DEMAND, CHEMICAL (E3246)

QUALITY CONTROL DATA FROM 11/01/01 TO 17/12/01

Analytical Range: to 400.0 mg/L as O₂

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	43	400	396.2	-3.8	4.6095
B:	43	100	100.7	0.7	6.4103
A+B:		500	496.9	-3.1	8.8056
A-B:		300	295.4	-4.6	6.8659

s.d.(AB)

S(between runs): 5.6

Sw(within run):4.9

S/Sw: 1.2

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

477.5 - 522.5 for A+B
285.0 - 315.0 for A-B

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
43	400	390.8	9.1558
43	100	98.7	9.4440

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
38	0 - 200	4.4455	10.9
14	201 - 400	11.2032	3.9
53	Overall	8.7334	

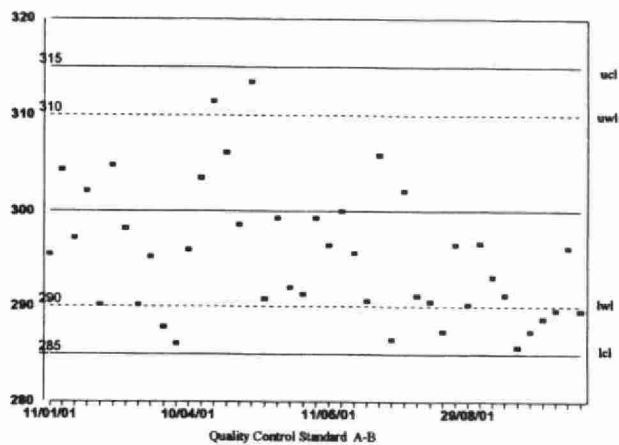
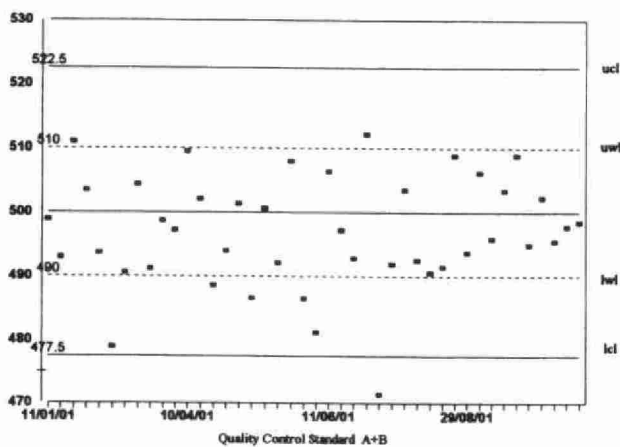
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Chloride Check	43	59.2	11.0593
Digested Blank	43	28.3	7.0907

OXYGEN DEMAND, CHEMICAL (E3246)

QUALITY CONTROL DATA FROM 11/01/01 TO 17/12/01

Analytical Range: to 400.0 mg/L as O₂



pH

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No	E3218	Reporting Units	Dimensionless
LIMS Product Code	PHALCO3218, CONDPH3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (20.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards. Total fixed endpoint alkalinity, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	2 QC standards e.g. QCA
Drift	In run standards throughout the run (diluted tap water 50% V/V)

pH (E3218)

QUALITY CONTROL DATA FROM 05/01/01 TO 24/12/01

Analytical Range: to 14.00 Dimensionless

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	107	7.41	7.42	0.01	0.0064
B:	107	4.45	4.52	0.07	0.0209
A+B:		11.86	11.94	0.08	0.0225
A-B:		2.96	2.90	-0.06	0.0211

s.d.(AB) S(between runs): 0.0154 Sw(within run): 0.0149 S/Sw: 1.03

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.64 - 12.08 for A+B
2.79 - 3.13 for A-B

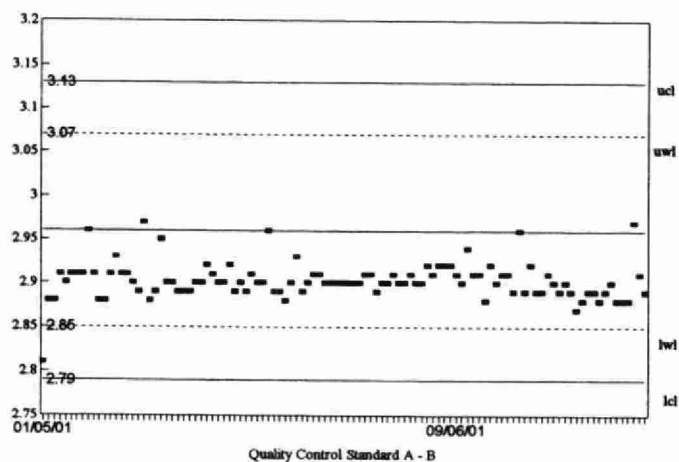
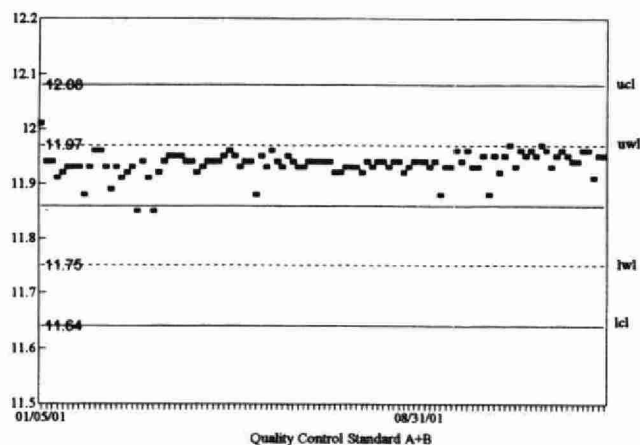
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
24	1.00 - 7.00	0.0606	1.0
136	7.01 - 8.00	0.0619	0.8
149	8.01 - 12.00	0.0444	0.5
309	Overall	0.0540	

pH (E3218)

QUALITY CONTROL DATA FROM 05/01/01 TO 24/12/01

Analytical Range: to 14.00 Dimensionless



pH

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/79
Method Reference No	E3248	Reporting Units	Dimensionless
LIMS Product Code	PHACD3248,PH3248	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Raw Sewage, Drinking Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	15 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (15.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards. Total fixed endpoint acidity and Gran acidity can be determined simultaneously if the sample volume exceeds 50 mL .

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
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NOTES:

A new automated system was introduced in Sept' 96.

pH (E3248)

QUALITY CONTROL DATA FROM 11/01/00 TO 31/10/01

Analytical Range: to 14.00 Dimensionless

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	20	4.45	4.426	-0.024	0.0526
B:	20	3.75	3.714	-0.036	0.0318
A+B:		8.20	8.139	-0.061	0.0783
A-B:		0.70	0.712	0.012	0.0378

s.d.(AB)

S(between runs): 0.04

S/Sw:(within run): 0.03

S/Sw: 1.5

On any given day the calibration is accepted if the values obtained lie within the ranges:

8.06 - 8.34 for A+B
0.59 - 0.81 for A-B

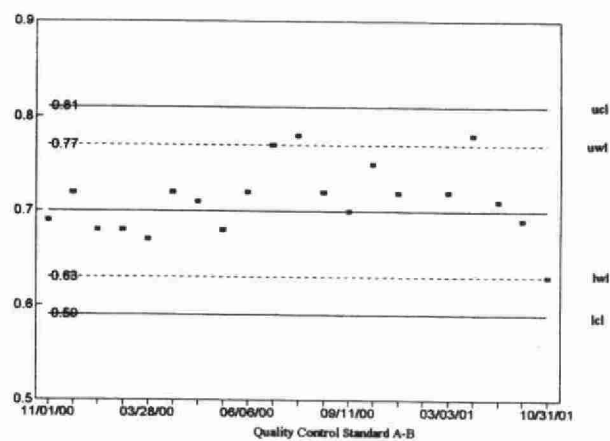
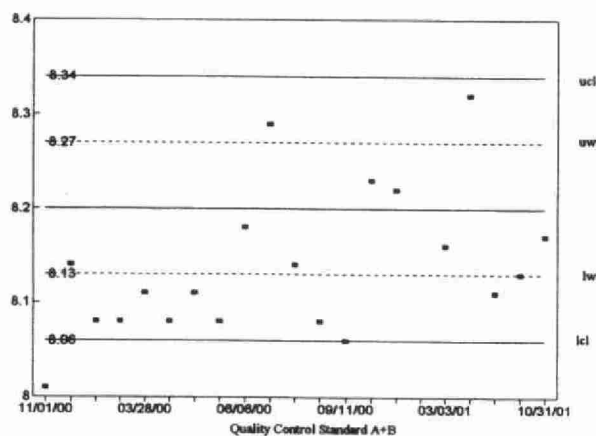
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)10
5	2.50 - 4.00	0.0100	0.3
18	4.01 - 5.00	0.0105	0.2
21	5.01 - 8.00	0.0126	0.2
44	Overall	0.0115	

pH (E3248)

QUALITY CONTROL DATA FROM 11/01/00 TO 31/10/01

Analytical Range: to 14.00 Dimensionless



PHENOLICS, REACTIVE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/74
Method Reference No.	E3179	Reporting Unit	µg/L as Phenol
LIMS Product Code	PHEN3179	Supervisor	P. Wilson
Sample Type/Matrix	Ground Water, Surface Water, Effluent, Drinking Water, Leachate, Raw Sewage, Industrial Waste, Process Water, Precipitation		

SAMPLING:

Quantity Required	250 mL
Container	Glass, (Phenol bottle with white cap containing preservative is available)
Preservative	Sulfuric acid to pH 1.5 - 2

ANALYTICAL PROCEDURE:

Samples are automatically distilled from an acid media, and reactive phenolics in the distillate are determined colourimetrically by formation of an antipyrene dye through reactions with 4-aminoantipyrene and potassium ferricyanide.

Approximate absorbance: 0.03 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 505 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1
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CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA (see note)
Drift	BL ,standard ,BL every 10 samples

NOTES:

An additional Quality Control Standard (QCC) was added to the method in March 1997.

PHENOLICS, REACTIVE (E3179)

QUALITY CONTROL DATA FROM 05/01/01 TO 14/12/01

Analytical Range: to 50.0 µg/L as Phenol

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	39	40	40.26	0.26	0.42
B:	39	10	10.25	0.25	0.19
C:	39	5	5.08	0.08	0.19
A+B:		50	50.51	0.51	0.49
A-B:		30	30.02	0.02	0.43
B+C:		15	15.31	0.31	0.33
B-C:		5	5.17	0.17	0.21

s.d.(AB) S(between runs):0.33

s.d.(BC) S(between runs):0.19

Sw(within run): 0.31

Sw(within run): 0.15

S/Sw: 1.1

S/Sw: 1.3

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

47.8	-	52.2	for	A+B
28.3	-	31.7	for	A-B
14	-	16	for	B+C
4.25	-	5.75	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
110	0.00 - 5.0	0.1386	29.3
1	5.1 - 10.0	N.A.	N.A.
1	10.1 - 25.0	N.A.	N.A.
0	25.1 - 50.0	N.A.	N.A.
112	Overall	0.1274	

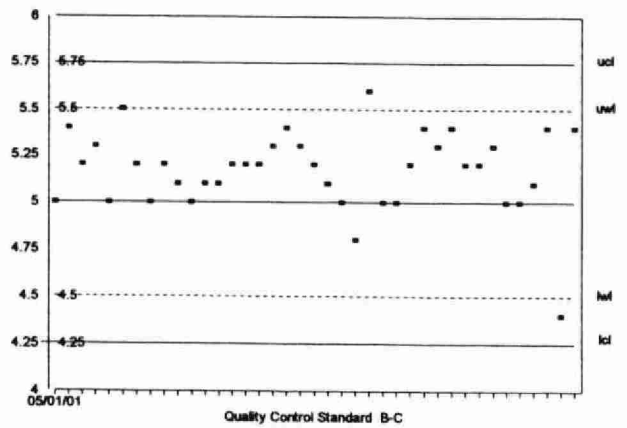
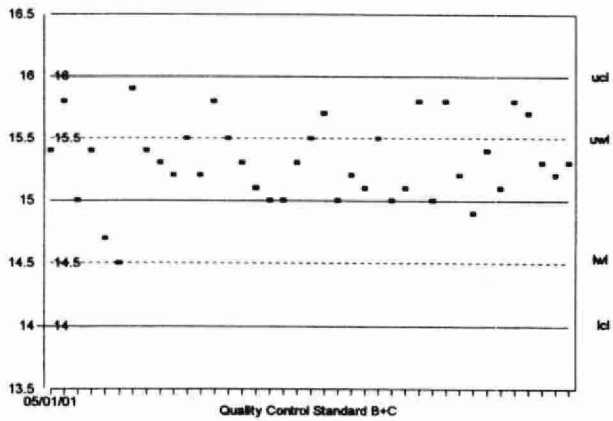
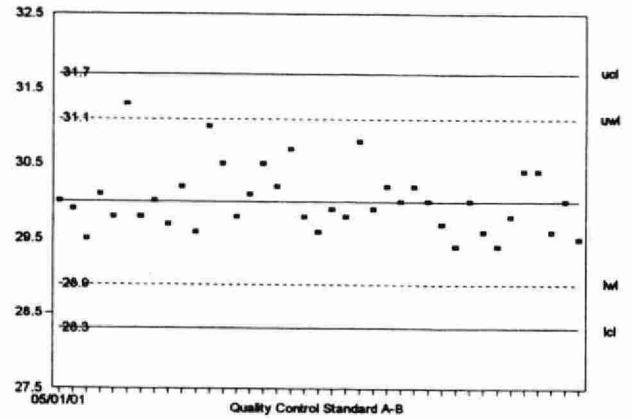
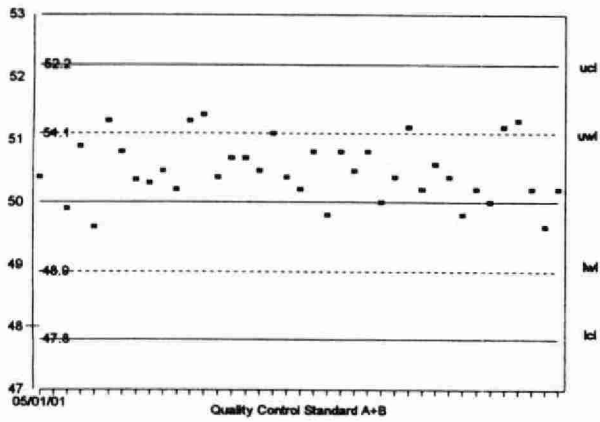
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	39	0.0513	0.2235

PHENOLICS, REACTIVE (E3179)

QUALITY CONTROL DATA FROM 05/01/01 TO 14/12/01

Analytical Range: to 50.0 µg/L as Phenol



PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3364	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Dried Sludge, Sediment, Soil, Vegetation, Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.2 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture, reduction, and processing via a multi-stage microcomputer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.0005	Current T value: 0.0025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard ,and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

PHOSPHORUS, REACTIVE ortho-PHOSPHATE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

Analytical Range: to 0.100 mg/L as P

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	104	0.080	0.0796	-0.0004	0.0011
B:	104	0.040	0.0402	0.0002	0.0008
C:	104	0.008	0.0081	0.0001	0.0008
A+B:		0.120	0.1198	-0.0002	0.0015
A-B:		0.040	0.0394	-0.0006	0.0013
B+C:		0.048	0.0483	0.0003	0.0013
B-C:		0.032	0.0321	0.0001	0.0011

s.d.(AB) S(between runs):0.0010

Sw(within run): 0.0009

S/Sw: 1.1

s.d.(BC) S(between runs):0.0008

Sw(within run): 0.0007

S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.1152 - 0.1248 for A+B

0.0364 - 0.0436 for A-B

0.0448 - 0.0512 for B+C

0.0296 - 0.0344 for B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
209	0.000 - 0.010	0.0009	33.3
24	0.011 - 0.020	0.0011	8.1
27	0.021 - 0.050	0.0018	5.7
10	0.051 - 0.100	0.0022	3.6
270	Overall	0.0011	

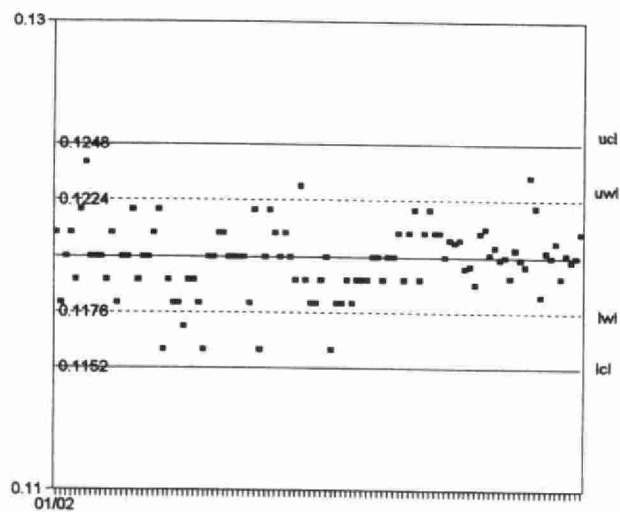
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	104	0.0001	0.0008

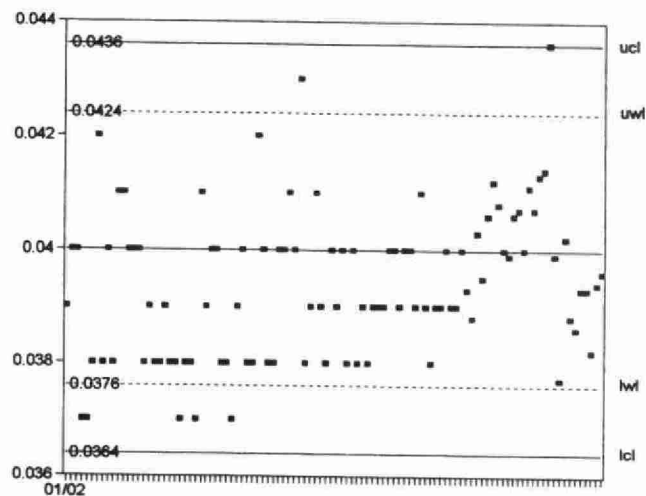
PHOSPHORUS, REACTIVE ortho-PHOSPHATE (E3364)

QUALITY CONTROL DATA FROM 02/01/01 TO 24/12/01

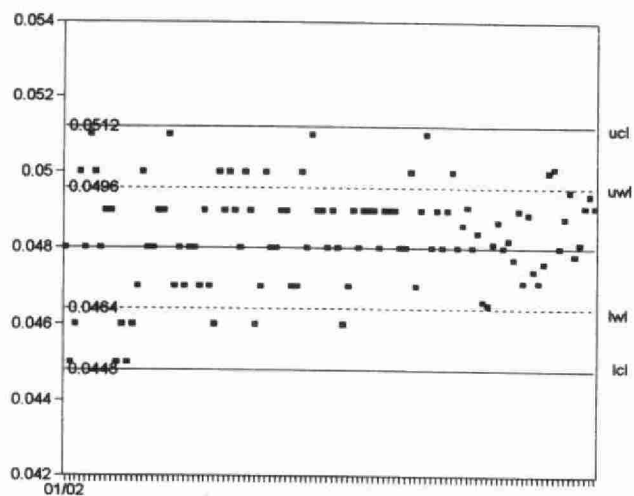
Analytical Range: to 0.100 mg/L as P



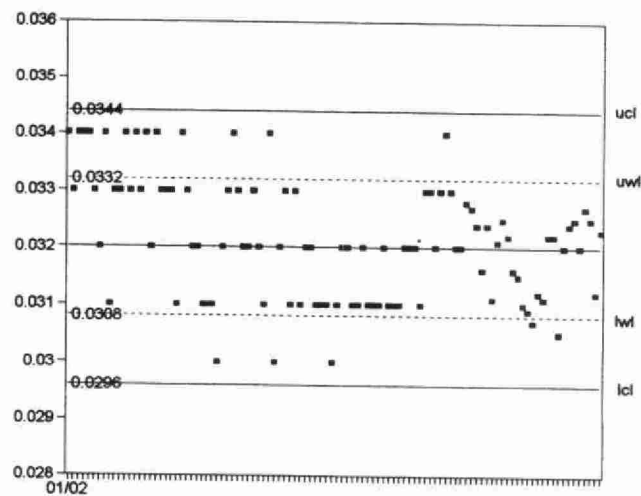
Quality Control Standard A+B



Quality Control Standard A-B



Quality Control Standard B+C



Quality Control Standard B-C

PHOSPHORUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3366	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Drinking Water, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.5 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.1
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

PHOSPHORUS, REACTIVE ortho-PHOSPHATE (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 10.0 mg/L as P

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	103	8.00	7.9995	-0.0005	0.0598
B:	103	4.00	4.0121	0.0121	0.0371
C:	103	0.800	0.8093	0.0093	0.0181
A+B:		12.0	12.0117	0.0117	0.0717
A-B:		4.00	3.9874	-0.0126	0.0690
B+C:		4.80	4.8215	0.0215	0.0437
B-C:		3.20	3.2028	0.0028	0.0387

s.d.(AB) S(between runs):0.0498

Sw(within run): 0.0488

S/Sw: 1.02

s.d.(BC) S(between runs):0.0292

Sw(within run): 0.0274

S/Sw: 1.07

The calibration is accepted if the calibration control values obtained lie within the ranges:

11.71	-	12.29	for	A+B
3.78	-	4.22	for	A-B
4.66	-	4.94	for	B+C
3.09	-	3.31	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
235	0.000 - 1.00	0.0227	21.3
19	1.01 - 2.00	0.0996	7.0
21	2.01 - 5.00	0.1018	3.4
3	5.01 - 10.0	0.0507	0.8
278	Overall	0.0439	

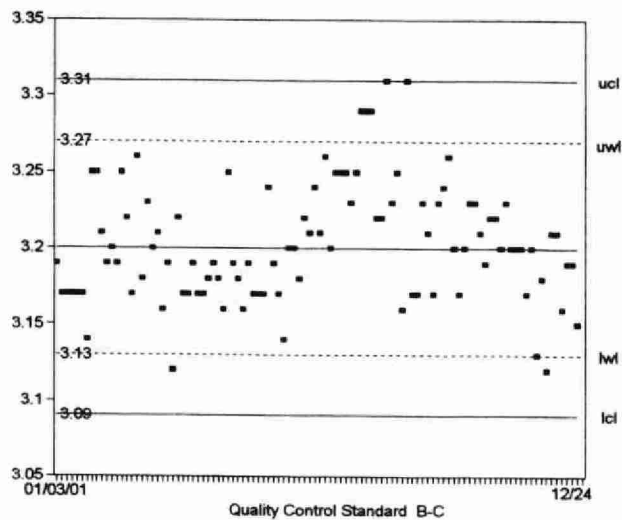
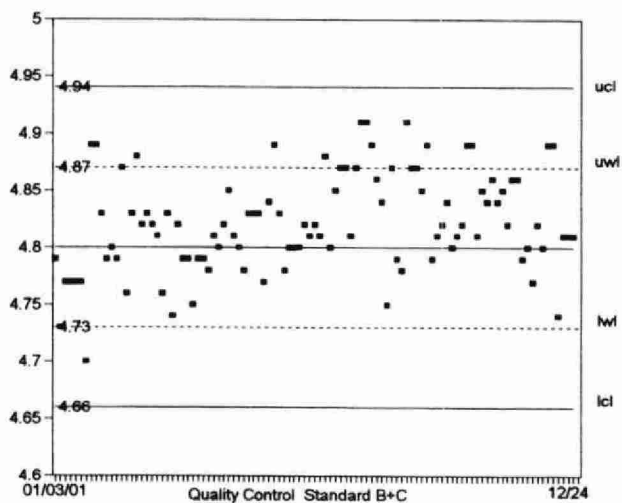
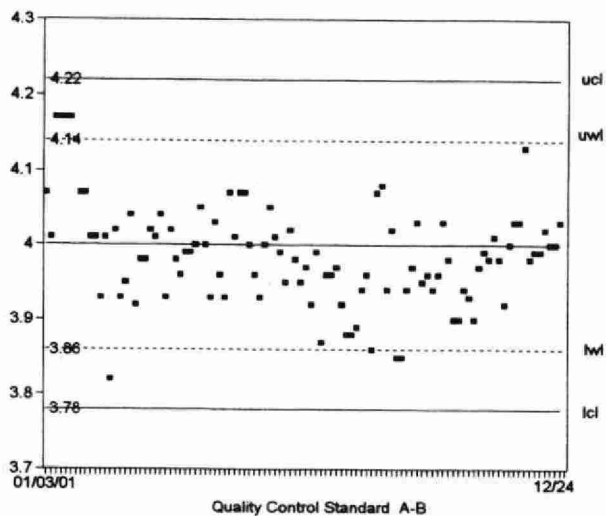
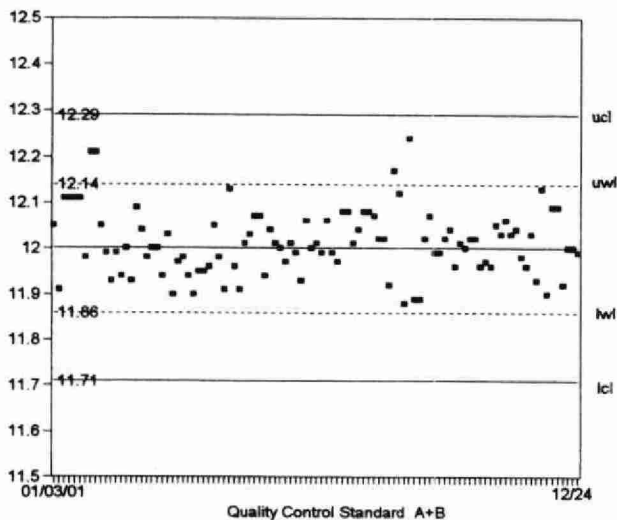
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	103	-0.0013	0.023

PHOSPHORUS, REACTIVE ortho-PHOSPHATE (E3366)

QUALITY CONTROL DATA FROM 03/01/01 TO 28/12/01

Analytical Range: to 10.0 mg/L as P



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as P
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate

Basic automated modular continuous flow system : Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing via a microcomputer system

REPORTING:

Maximum Significant Figures: 3 decimal places	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite B-Soil/sediment, plus QC Soils/Sediment (RS92)
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards.

PHOSPHORUS, TOTAL (E3116)

QUALITY CONTROL DATA FROM 18/01/01 TO 19/12/01

Analytical Range: to 2 mg/g as P

QUALITY CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
RS92 In House Soil Composite	25	0.47	0.449	-0.021	0.0575
RSM-2781 - Domestic Sludge (non certified)	55	24.0	23.983	-0.017	2.0464

The run is accepted if the control values obtained lie within the ranges:

0.4 - 0.54 for RS92
17.9 - 30.1 for RSM-2781

Recovery Standards

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
R1	25	1.05	1.061	0.0250
R2	25	0.35	0.366	0.0260

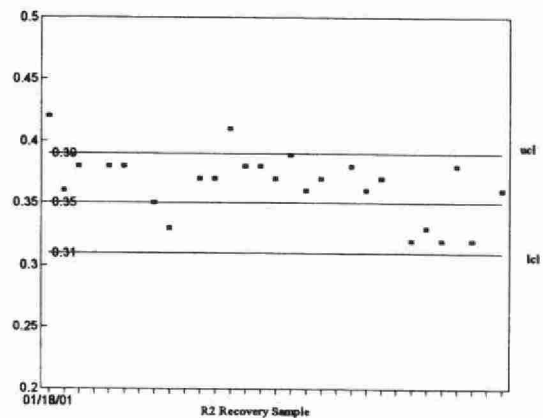
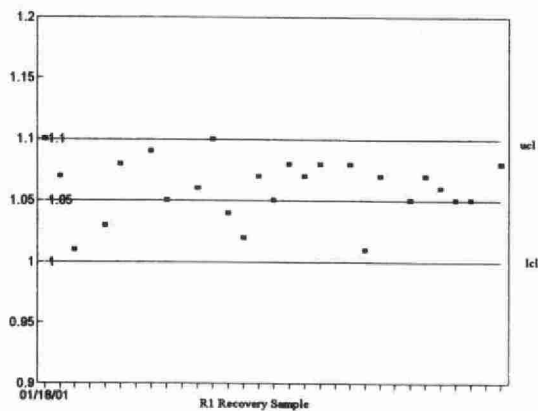
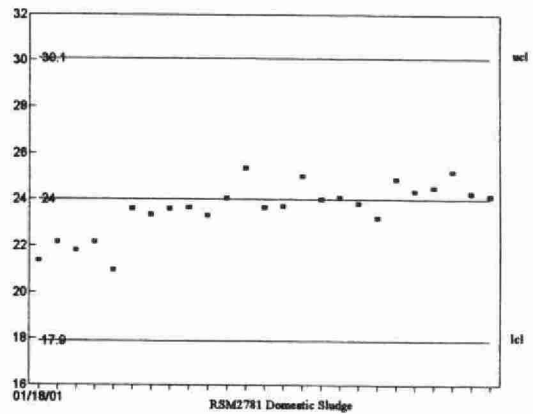
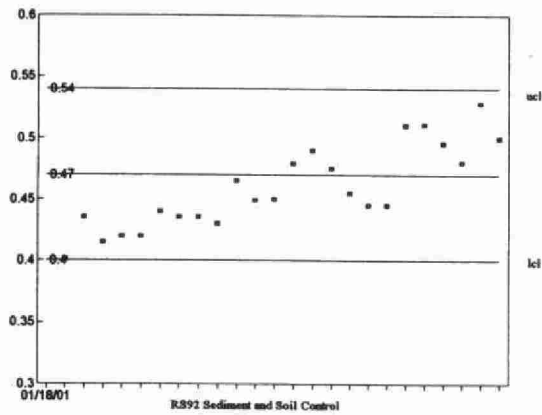
DUPLICATES: (Sediment/Soils)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
24	0.00 - 0.50	0.0251	7.9
30	0.51 - 1.00	0.0673	8.9
8	1.00 - 2.50	0.1144	6.9
13	2.51 - 5.00	0.1387	4.0
73	Overall	0.0828	

PHOSPHORUS, TOTAL (E3116)

QUALITY CONTROL DATA FROM 18/01/01 TO 19/12/01

Analytical Range: to 2 mg/g as P



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3118	Reporting Unit	mg/g as P
LIMS Product Code	TNP3118	Supervisor	P. WILSON
Sample Type/Matrix	Vegetation, Moss Bag		

SAMPLING:

Quantity Required	0.02 to 0.04 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate.

Basic automated modular continuous flow system : Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing via a microcomputer system.

REPORTING:

Maximum Significant Figures: 3 decimal places	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite A-VEG, plus QC VEG (Pine Needles)
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards.

PHOSPHORUS, TOTAL (E3118)

QUALITY CONTROL DATA FROM 18/01/01 TO 19/12/01

Analytical Range: to 5 mg/g as P

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
Pine Needles	7	1.2	1.147	-0.0529	0.0451

The calibration is accepted if the calibration control values obtained lie within the ranges:
1 - 1.4 for pine needles

Recovery Standards

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
R1	25	1.05	1.061	0.0250
R2	25	0.35	0.366	0.0260

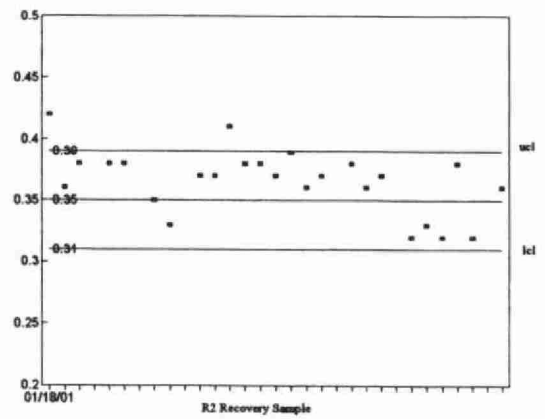
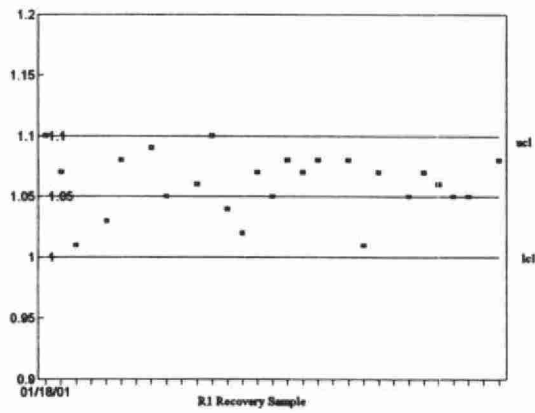
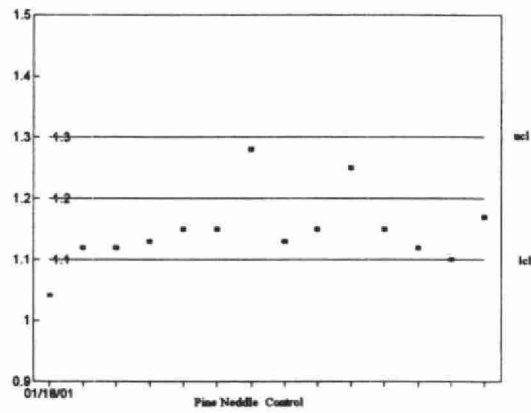
DUPLICATES: (VEGITATION)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
0	0.00 - 0.50	N.A.	N.A.
3	0.51 - 2.50	0.1077	4.5
11	2.51 - 5.00	0.1391	4.1
14	Overall	0.1330	

PHOSPHORUS, TOTAL (E3118)

QUALITY CONTROL DATA FROM 18/01/01 TO 19/12/01

Analytical Range: to 5 mg/g as P



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3367	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Ground Water , Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digesters kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.4 at the full scale level.

Total Kjeldahl nitrogen is determined simultaneously.

INSTRUMENTATION:

Three Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using appropriate phototube.

Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.01
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL , undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by Labtronics in May 1999.

PHOSPHORUS, TOTAL (E3367)

QUALITY CONTROL DATA FROM 04/01/01 TO 24/12/01

Analytical Range: to 0.200 mg/L as P

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	105	0.160	0.1618	0.0018	0.0007
B:	105	0.080	0.0807	0.0007	0.0006
C:	105	0.016	0.0156	-0.0004	0.0006
A+B:		0.240	0.2425	0.0025	0.0011
A-B:		0.080	0.0812	0.0012	0.0008
B+C:		0.096	0.0962	0.0002	0.0010
B-C:		0.064	0.0651	0.0011	0.0007

s.d.(AB) S(between runs): 0.0007 Sw(within run): 0.0005 S/Sw: 1.22
s.d.(BC) S(between runs): 0.0006 Sw(within run): 0.0005 S/Sw: 1.25

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.2332 - 0.2468 for A+B
0.0749 - 0.0851 for A-B
0.092 - 0.100 for B+C
0.061 - 0.067 for B-C

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
105	0.140	0.1396	0.0041
105	0.084	0.0843	0.0019
105	0.029	0.0285	0.0014

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
201	0.000 - 0.020	0.0038	41.9
48	0.021 - 0.040	0.0049	18.5
46	0.041 - 0.100	0.0037	6.0
13	0.101 - 0.200	0.0055	4.1
308	Overall	0.0040	

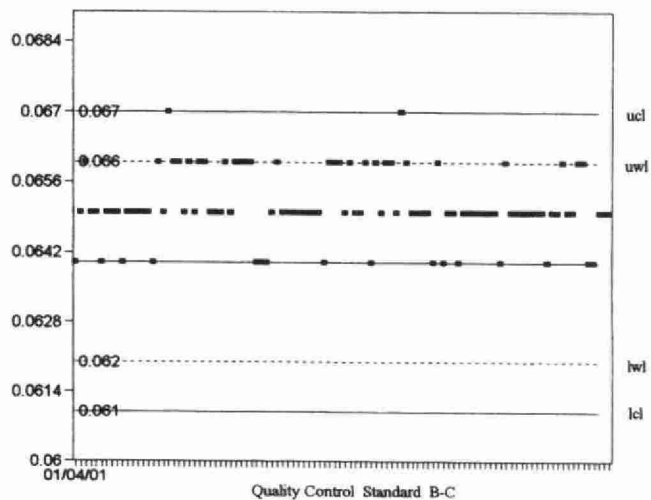
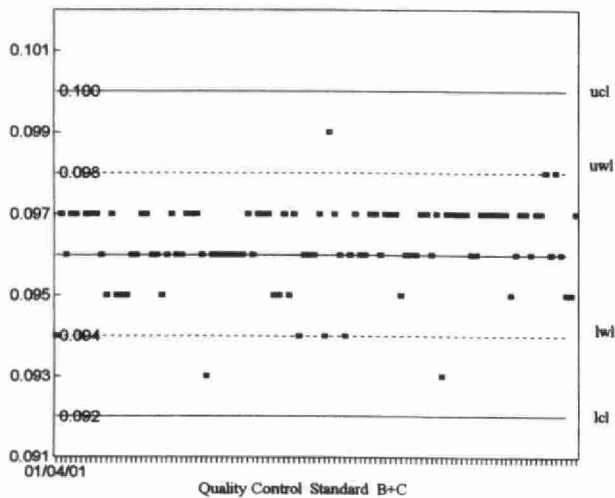
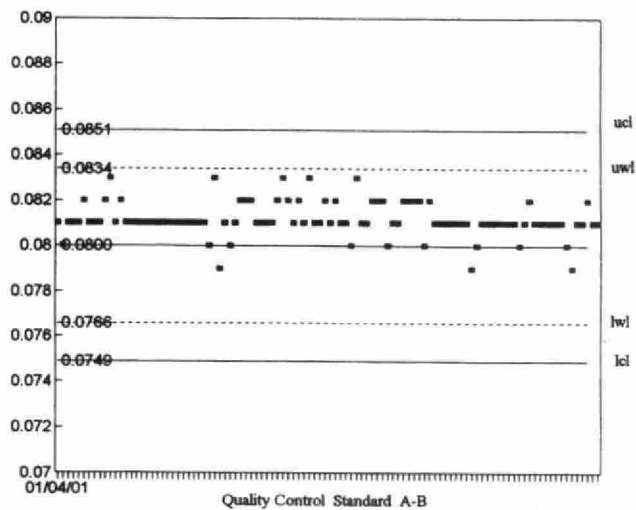
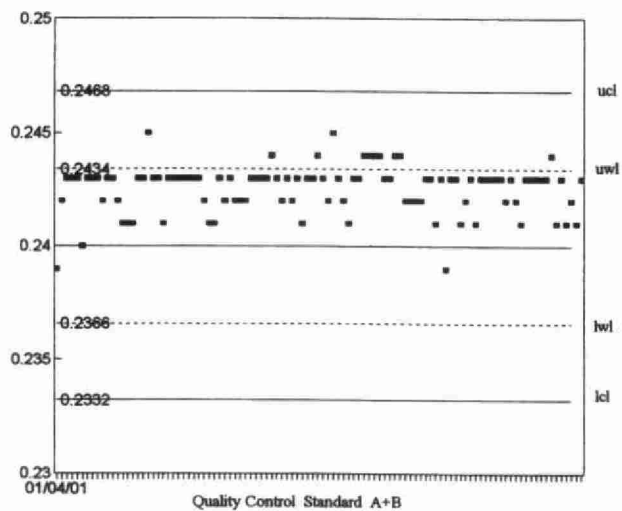
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	105	0.0003	0.0006
Digested Blank	105	0.0010	0.0011

PHOSPHORUS, TOTAL (E3367)

QUALITY CONTROL DATA FROM 04/01/01 TO 24/12/01

Analytical Range: to 0.200 mg/L as P



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3368	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Drinking Water, Effluent, Ground Water, Process Water, Leachate, Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.8 at the full scale level.

Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

3-Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using an IR sensitive phototube. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL every 10 samples; undigested standard every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by Labtronics in April 1999

PHOSPHORUS, TOTAL (E3368)

QUALITY CONTROL DATA FROM 02/01/01 TO 28/12/01

Analytical Range: to 10.0 mg/L as P

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	70	8.0	7.979	-0.021	0.0437
B:	70	4.0	4.004	0.004	0.0234
C:	70	0.8	0.799	-0.001	0.0155
A+B:		12.0	11.982	-0.018	0.0613
A-B:		4.0	3.975	-0.025	0.0338
B+C:		4.8	4.803	0.003	0.0300
B-C:		3.2	3.205	0.005	0.0260

s.d.(AB) S(between runs): 0.0268 Sw(within run): 0.0235 S/Sw: 1.1
s.d.(BC) S(between runs): 0.0160 Sw(within run): 0.0150 S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

11.87 - 12.13 for A+B
3.903 - 4.097 for A-B
4.732 - 4.868 for B+C
3.149 - 3.251 for B-C

RECOVERIES:

Number of Data	Expected Concentration	Mean Concentration	Standard Deviation (1)
69	7	6.87	0.1212
69	4.2	4.14	0.0768
69	1.4	1.40	0.0321

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
156	0.00 - 1.00	0.0647	27.4
20	1.00 - 2.00	0.0497	3.3
29	2.00 - 5.00	0.0810	2.7
2	5.00 - 10.00	N.A.	N.A.
207	Overall	0.0657	

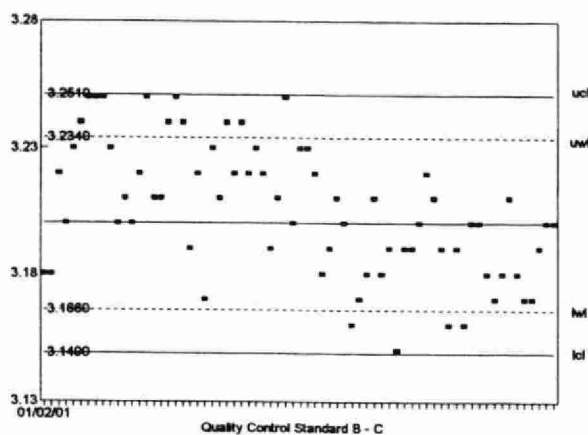
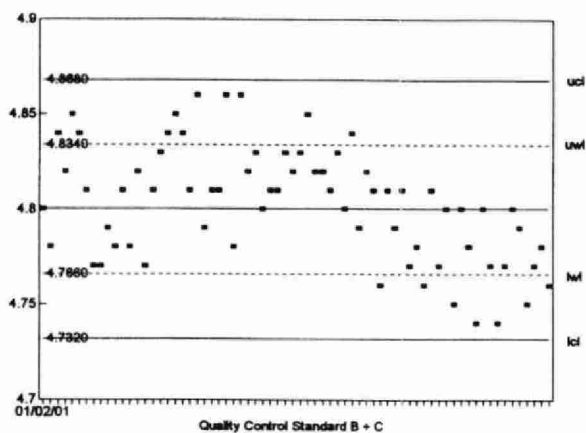
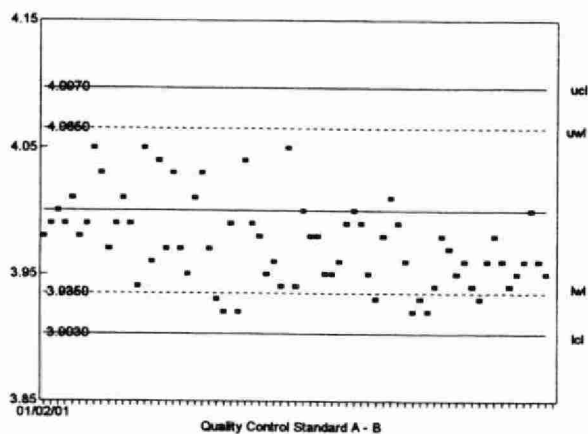
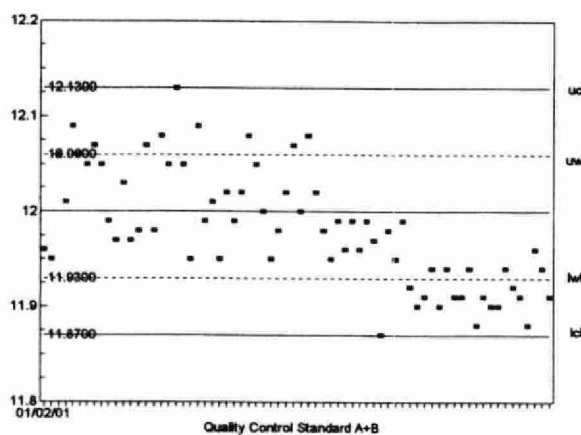
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	70	0.011	0.0165
Digested Blank	70	0.015	0.0181

PHOSPHORUS, TOTAL (E3368)

QUALITY CONTROL DATA FROM 02/01/01 TO 28/12/01

Analytical Range: to 10.0 mg/L as P



SILICON, REACTIVE SILICATES

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/02/75
Method Reference No.	E3370	Reporting Unit	mg/L as Si
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Reactive silicates are determined by formation of a reduced molybdo-silicate complex at pH 1.6, using ascorbic acid as the reducing agent, and oxalic acid to suppress phosphate interference.

Approximate absorbance: 0.7 at the full scale level.

Dissolved inorganic and dissolved organic carbon are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 660 nm. Data capture and processing via a PC.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL, standard and BL every 10 samples.

NOTES:

December 1998: The HP data capture/processing system was replaced by a Labtronics / in-house Visual Basic application.

SILICON, REACTIVE SILICATES (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 20/12/01

Analytical Range: to 10.0 mg/L as Si

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	61	8.00	7.976	-0.024	0.0488
B:	61	2.00	1.994	-0.006	0.0252
C:	61	0.50	0.485	-0.015	0.0222
A+B:		10.00	9.970	-0.030	0.0611
A-B:		6.00	5.983	-0.018	0.0479
B+C:		2.50	2.479	-0.021	0.0442
B-C:		1.50	1.509	0.009	0.0172

s.d.(AB) S(between runs): 0.039

Sw(within run): 0.034

S/Sw: 1.1

s.d.(BC) S(between runs): 0.024

Sw(within run): 0.009

S/Sw: 2.0

The calibration is accepted if the calibration control values obtained lie within the ranges:

9.66	-	10.34	for	A+B
5.75	-	6.25	for	A-B
2.37	-	2.63	for	B+C
1.4	-	1.62	for	B-C

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
76	0.00 - 1.00	0.0095	2.2
39	1.01 - 2.00	0.0137	0.9
46	2.01 - 5.00	0.0170	0.5
14	5.01 -10.00	0.0241	0.4
175	Overall	0.0143	

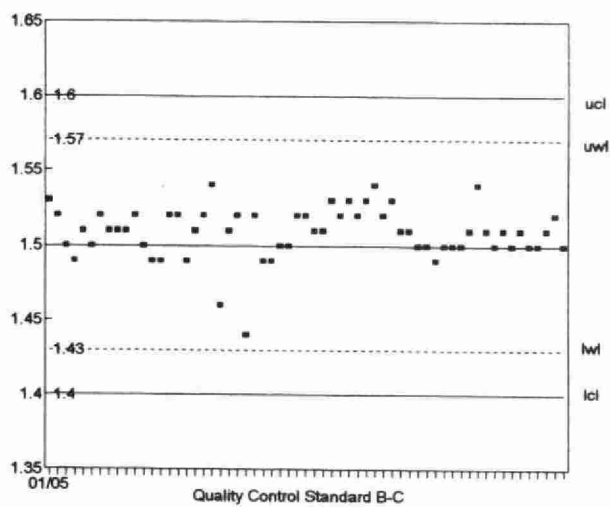
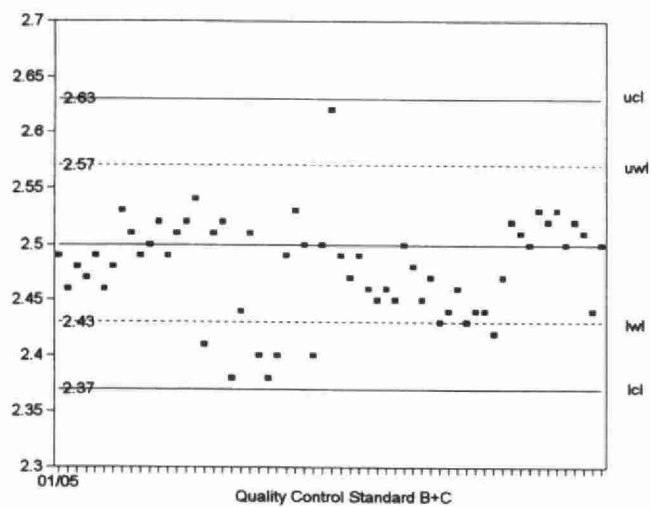
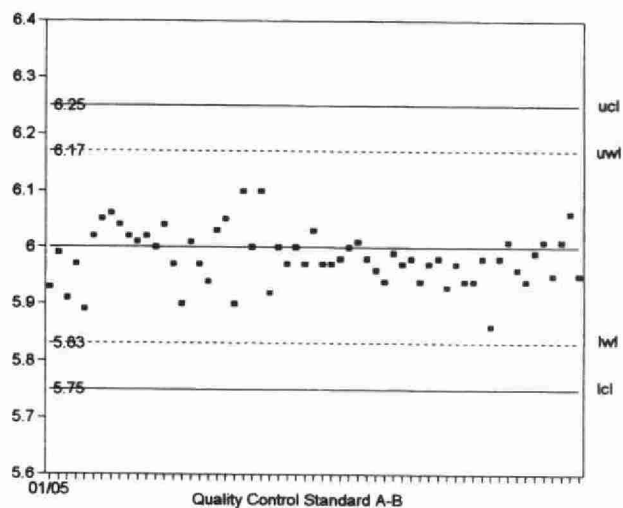
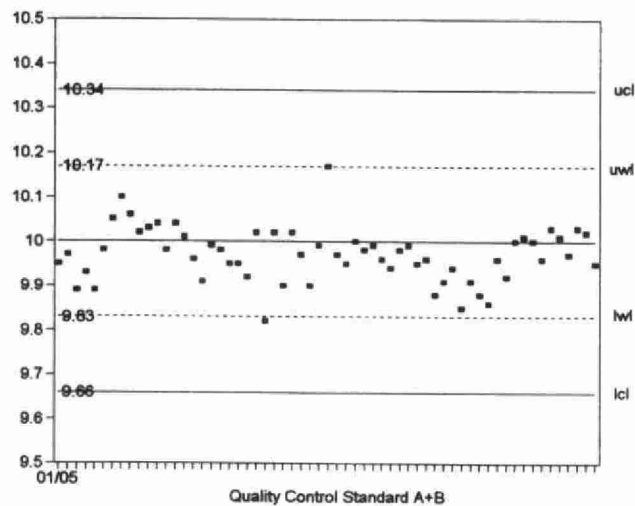
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	69	-0.0153	0.0679

SILICON, REACTIVE SILICATES (E3370)

QUALITY CONTROL DATA FROM 05/01/01 TO 20/12/01

Analytical Range: to 10.0 mg/L as Si



SOLIDS, DISSOLVED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188,DS3188,DIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sample is filtered under moderate suction through a Whatman 934AH grade glass fibre filter. Generally 100 mL of filtrate (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at $103 \pm 2^{\circ}\text{C}$, and stored in a desiccator for at least 24 hours. The dissolved solids content is calculated by subtracting the original dish mass from the dried residue + dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 decimal places), drying oven, suction filtration apparatus, dishes (Teflon).
Microcomputer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

Balance zero
Balance internal calibration is performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	100 mL Pure Water.

SOLIDS, DISSOLVED (E3188)

QUALITY CONTROL DATA FROM 10/01/01 TO 20/12/01

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	61	50.00	50.0006	0.0006	0.00006
B:	61	30.00	30.0003	0.0003	0.00005
A+B:		80.00	80.0009	0.0009	0.00008
A-B:		20.00	20.0002	0.0002	0.00007

s.d.(AB) S(between runs): 0.00005 Sw(within run): 0.00005 S/Sw: 0.98

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

80.0005 - 80.0013 for A+B
20.0000 - 20.0006 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
61	2000.0	1999.58	12.79
61	500.0	495.79	13.98

DUPLICATES:

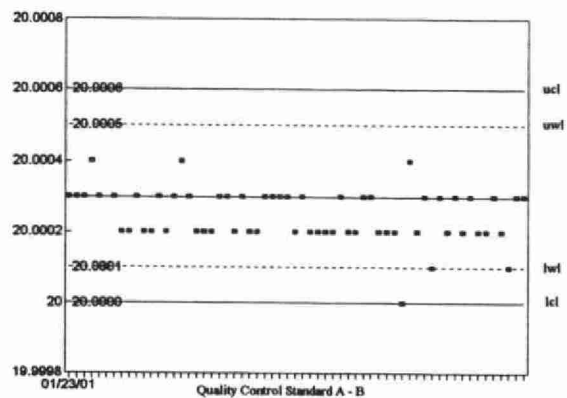
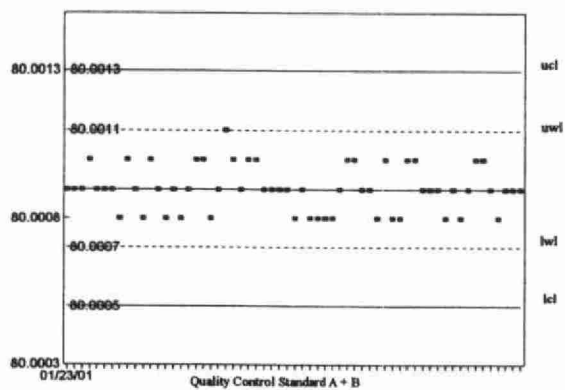
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
6	0 - 500	10.3730	2.7
48	501 - 1000	15.0167	2.2
19	1001 - 5000	39.6011	2.6
73	Overall	23.7759	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	61	0.3741	9.2703

DISSOLVED, SOLIDS (E3188)

QUALITY CONTROL DATA FROM 10/01/01 TO 20/12/01



SOLIDS, SUSPENDED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188, SS3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

An appropriately shaken sample volume (5 to 500 mL) is pipetted or quickly poured into a graduated cylinder, and the volume is measured. The aliquot is then filtered under moderate suction through a preweighed Whatman 934AH glass fibre filter. The graduated cylinder and then the filter are washed with a total of 50 mL distilled water. The filter is dried at 103-105°C, and suspended solids content is calculated by subtracting the original filter mass from the dried filter mass. Data collection, calculations, and transfer of results to LIMS are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5-decimal places), drying oven, suction filtration apparatus.
Microcomputer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	Filter washed with 500 mL distilled water

NOTES:

A standard correction factor (-0.00022g) was applied to all filters to account for weight loss during filtering. A new set of Q.C. weights was introduced for the year 2000, along with new limits for the weights.

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 15/01/01 TO 19/12/01

CALIBRATION CONTROL: (QC data from SS3188)

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	239	0.50	0.49986	-0.00014	0.00018
D:	239	0.05	0.04995	-0.00015	0.00001
C+D:		0.55	0.54981	-0.00019	0.00018
C-D:		0.45	0.44991	-0.00009	0.00018

s.d.(CD) S(between runs): 0.00013 Sw(within run): 0.00013 S/Sw: 1.00

The calibration is accepted if the calibration control values (mean mass measured) obtained within the ranges expressed in grams:

0.55006 - 0.54966 for C+D
0.45012 - 0.44982 for C-D

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
239	200.0	196.63	2.4734
239	50.0	48.95	2.2458

DUPLICATES:

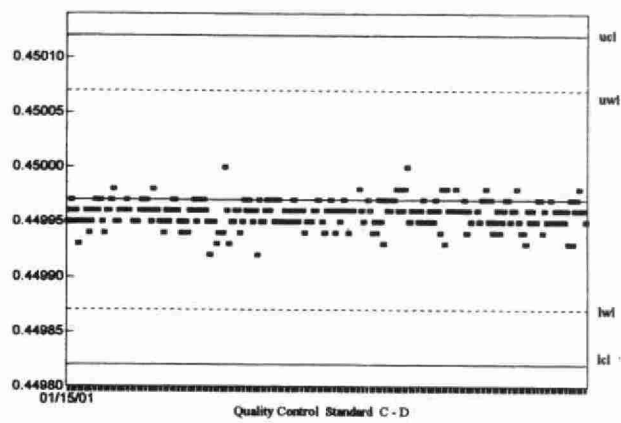
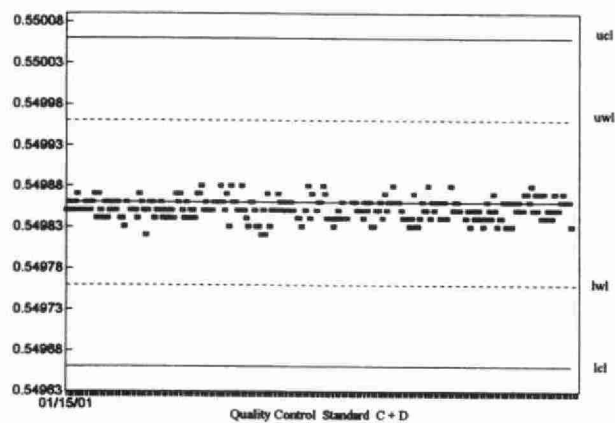
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
78	0 - 5	0.3127	13.6
65	6 - 10	0.5569	7.8
63	11 - 25	0.9893	6.1
107	26 - 100	2.2345	4.3
51	101 - 500	6.7053	3.6
5	501 - 1000	32.7712	5.7
10	1001 - 10000	37.8398	2.7
379	Overall	7.7229	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	239	-0.0172	0.1669

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 15/01/01 TO 19/12/01



SOLIDS, SUSPENDED IGNITED
(Particulate Ash and Particulate Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	SIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for particulate solids (SS3188) is followed and the dried residue is ignited at $600 \pm 50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The particulate ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for SS3188. The particulate loss on ignition (estimate of volatile suspended solids) is the difference between the final ignited mass plus filter and the residue (suspended solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes
 Microcomputer system with appropriate software

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.

SOLIDS, SUSPENDED IGNITED (E3188)
(Particulate Ash and Particulate Loss On Ignition)

QUALITY CONTROL DATA FROM 15/01/01 TO 31/12/01

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	24	0.50	0.49991	-0.0001	0.00002
D:	24	0.05	0.04995	-0.0001	0.00001
C+D:		0.55	0.54986	-0.0001	0.00002
C-D:		0.45	0.44996	0.0000	0.00002

s.d.(CD) S(between runs): 0.00002 Sw(within run): 0.00002 S/Sw: 0.93

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

0.54981 - 0.54989 for C+D
0.44993 - 0.44999 for C-D

SOLIDS, SUSPENDED IGNITED (PARTICULATE ASH)

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
19	0 - 100.0	3.5667	13.0
0	100.1 - 500.0	N.A.	N.A.
0	500.1 - 1000.0	N.A.	N.A.
20	1000.1 - 5000.0	107.5135	4.6
39	Overall	77.0322	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	24	-0.4042	0.2246

SOLIDS, SUSPENDED IGNITED (E3188)
(Particulate Ash and Particulate Loss On Ignition)

SOLIDS, SUSPENDED IGNITED (PARTICULATE LOSS ON IGNITION)

DUPLICATES:

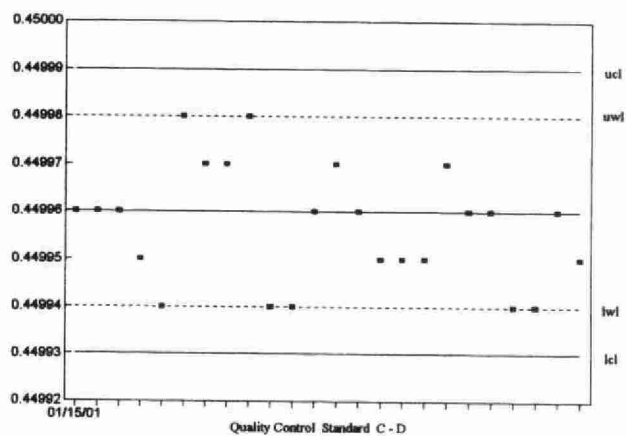
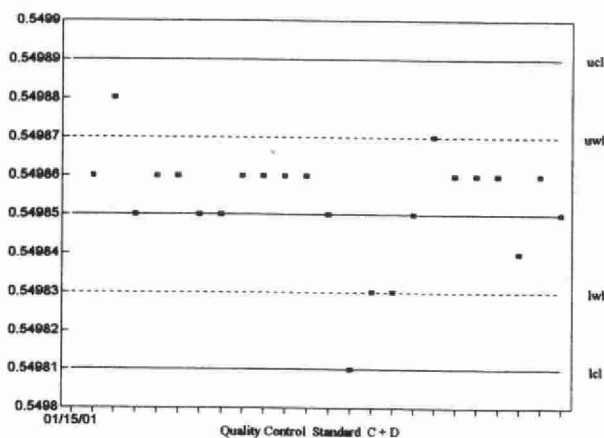
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
15	0 - 50.0	0.6221	0.0
4	50.1 - 100.0	3.1107	0.0
1	100.1 - 1000.0	N.A.	N.A.
18	1000.1 - 5000.0	137.3994	0.9
38	Overall	94.8735	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	24	0.0258	0.1009

Solids, Suspended Ignited (E3188)
(Particulate Ash and Particulate Loss on Ignition)

QUALITY CONTROL DATA FROM 15/01/01 TO 31/12/01



SOLIDS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L or mg/Kg
LIMS Product Code	TS3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Generally, 100 mL aliquot of sample (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103-105°C, and stored in a desiccator for at least 24 hours. The total residue or solids content is calculated by subtracting the original dish mass from the dried dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 decimal places), drying oven, dishes (Teflon).
Microcomputer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10
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CALIBRATION:

Balance zero
Balance internal calibration performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1

SOLIDS, TOTAL (E3188)

QUALITY CONTROL DATA FROM 29/01/01 TO 06/12/01

CALIBRATION CONTROL: (QC data from TS3188)

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	17	50.00	50.00058	0.0006	0.00006
B:	17	30.00	30.00034	0.0003	0.00005
A+B:		80.00	80.00092	0.0009	0.00010
A-B:		20.00	20.00024	0.0002	0.00005

s.d.(AB)

S(between runs): 0.00005

Sw(within run): 0.00003

S/Sw: 1.54

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

80.0008 - 80.0012 for A+B
20.0001 - 20.0005 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
17	20000.0	20217.31	129.0
17	2000.0	1995.99	10.8

DUPLICATES:

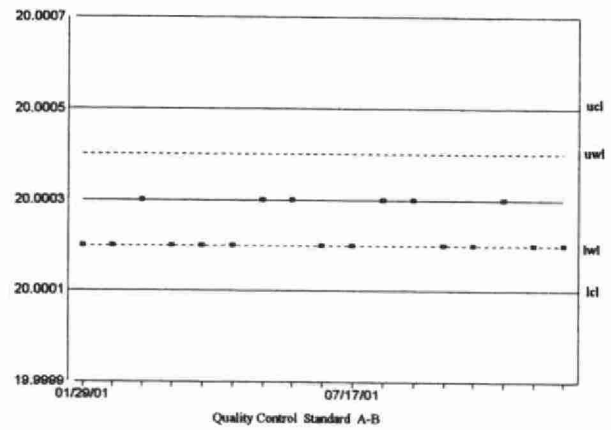
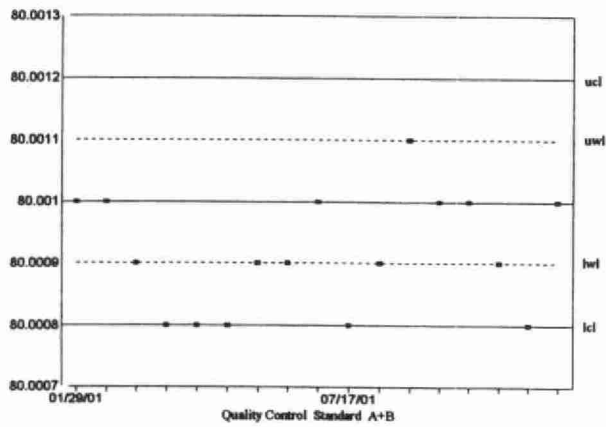
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
4	0 - 6000	110.1798	6.2
15	6001 - 25000	116.6341	0.9
2	25001 - 50000	277.8331	0.8
21	Overall	139.2144	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	17	-1.9888	4.0877

SOLIDS, TOTAL (E3188)

Quality Control Data From 29/01/01 To 06/12/01



SOLIDS, TOTAL IGNITED
(Ash and Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for total solids (TS3188) is followed and the dried residue is ignited at $600 \pm 50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for TS3188. The loss on ignition (estimate of volatile total solids) is the difference between the final ignited mass plus filter and the residue (total solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes.
Microcomputer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.

SOLIDS, TOTAL IGNITED (E3188)
(Ash and Loss On Ignition)

QUALITY CONTROL DATA FROM 02/02/01 TO 17/12/01

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	35	50.00	50.0006	0.0006	0.00005
B:	35	30.00	30.0003	0.0003	0.00006
A+B:		80.00	80.0009	0.0009	0.00009
A-B:		20.00	20.0002	0.0002	0.00006

s.d.(AB)

S(between runs): 0.00005

Sw(within run):

0.00004

S/Sw: 1.36

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

80.0005 - 80.0013 for A+B
20.0000 - 20.0006 for A-B

SOLIDS, TOTAL IGNITED (DRY)

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
35	20000.0	19956.2	166.35
35	2000.0	1983.8	26.87

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
25	0 - 3000	106.5	8.2
4	3001 - 5000	165.9	1.4
8	5001 - 15000	154.9	0.8
11	15001 - 40000	418.4	1.3
48	Overall	432.7	

**SOLIDS, TOTAL IGNITED cont'd
(Ash and Loss On Ignition)**

SOLIDS, TOTAL IGNITED (ASH)

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
25	0 - 3000	11.4	1.2
13	3001 - 10000	222.0	3.5
4	10001 - 15000	673.3	5.2
6	15000 - 25000	103.5	0.6
48	Overall	229.19	

OTHER CHECKS:

Ashed	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	35	-1.557	6.4279

SOLIDS, TOTAL IGNITED (LOSS ON IGNITION)

DUPLICATES:

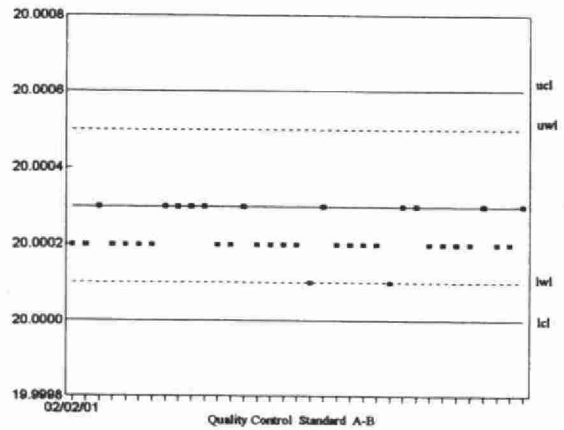
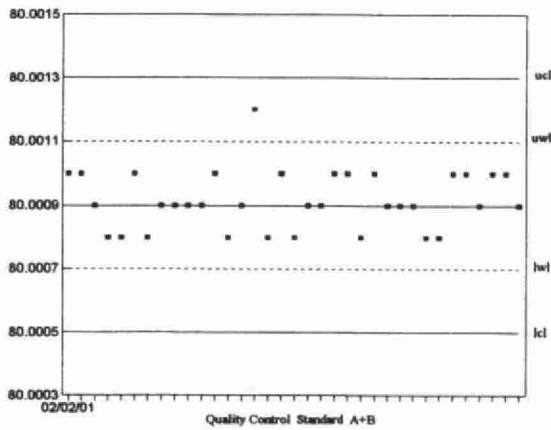
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
26	0 - 5000	106.4	14.4
10	5001 - 10000	161.5	1.5
12	10001 - 25000	477.7	2.7
48	Overall	261.9	

OTHER CHECKS:

LOI	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	35	2.4997	3.6888

SOLIDS, TOTAL IGNITED (E3188)

Quality Control Data From 02/02/01 To 17/12/01



SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as SO_4
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as SO_4 .

Chloride and nitrate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:

6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2
Drift	Duplicate plus 2 standards approximately every 20 samples

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of SO_4 in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

SULFATE (E3004)

QUALITY CONTROL DATA FOR 2001

Analytical Range: to 28.61 $\mu\text{g}/\text{m}^3$

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
23	0.00 - 2.86	0.059	3.7
18	2.89 - 7.15	0.067	1.5
16	7.18 - 14.31	0.179	1.7
6	14.33 - 24.90	0.158	0.9
63	Overall	0.114	

SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Units	µg/g as SO ₄
LIMS Product Code	ANION3013, SUL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0 g sample air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as SO₄.

Chloride is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g
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CALIBRATION:

8 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2
Drift	Duplicate plus 2 standards approximately every 20 samples

SULFATE (E3013)

QUALITY CONTROL DATA FOR 2001

Analytical Range: to 1000 µg/g

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
20	0.00 - 200	1.6397	2.4
12	201 - 500	3.5459	1.2
3	501 - 1000	12.7056	1.9
35	Overall	4.4367	

SULPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/82
Method Reference No.	E3172	Reporting Unit	mg/L as SO ₄
LIMS Product Code	SULP3172	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO₄ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CALIBRATION:

BL plus 10 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	1 standard every 10 samples

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 08/01/01 TO 29/09/01

Analytical Range: to 100.0 mg/L as SO₄

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	49	80.0	80.8	0.8	0.8112
B:	49	20.0	20.1	0.1	0.3112
A+B:		100.0	100.9	0.9	0.9022
A-B:		60.0	60.7	0.7	0.8154

s.d.(AB)

S(between runs): 0.61

Sw(within run): 0.58

S/Sw: 1.05

The calibration is accepted if the calibration control values obtained lie within the ranges:

97.2 - 102.8 for A+B
57.9 - 62.1 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
24	0.0 - 10.0	0.3611	1.4
29	10.1 - 20.0	0.6502	4.2
59	20.1 - 50.0	1.1306	3.9
21	50.1 - 100.0	2.0048	3.4
133	Overall	1.1477	

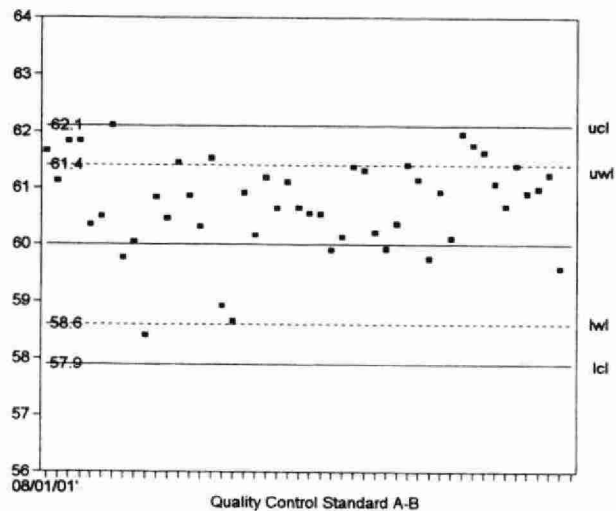
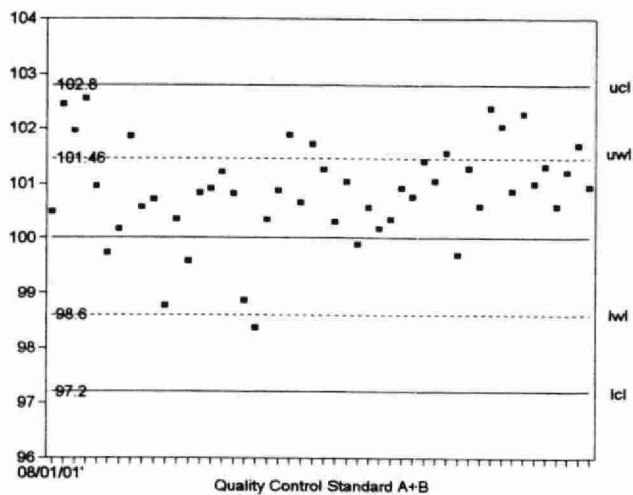
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	49	0	0

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 08/01/01 TO 29/09/01

Analytical Range: to 100.0 mg/L as SO_4



SULPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/82
Method Reference No.	E3172	Reporting Unit	mg/L as SO ₄
LIMS Product Code	SULP3172, Anion3172	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO₄ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

NOTE:

Method revised to accommodate the analysis of Fluoride. New QC range added. (October 1, 2001)
The data for QCA and QCB on December 18, 2001 were within the individual acceptable limits. The run was subsequently accepted.

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 04/10/01 TO 22/12/01

Analytical Range: to 100.0 mg/L as SO₄

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	15	80.0	79.02	-0.98	0.92
B:	15	40.0	40.11	0.11	0.36
C:	15	8.0	8.04	0.04	0.14
A+B:		120.0	119.13	-0.87	1.15
A-B:		40.0	38.91	-1.09	0.80
B+C:		48.0	48.15	0.15	0.34
B-C:		32.0	32.08	0.08	0.42

s.d.(AB) S(between runs): 0.70

Sw(within run): 0.27

S/Sw: 1.05

The calibration is accepted if the calibration control values obtained lie within the ranges:

116.8	-	123.2	for	A+B
37.6	-	42.4	for	A-B
46.3	-	49.7	for	B+C
30.7	-	33.3	for	B-C

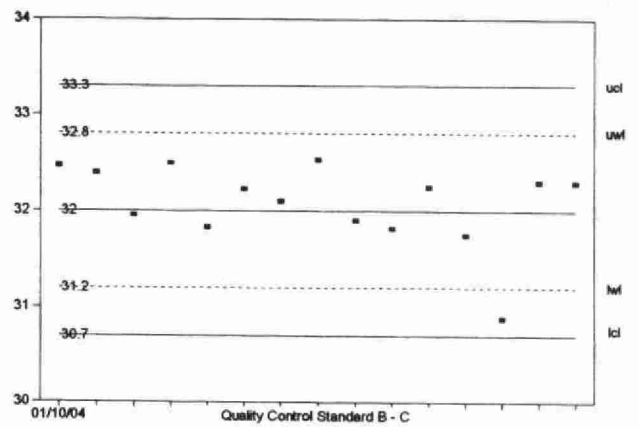
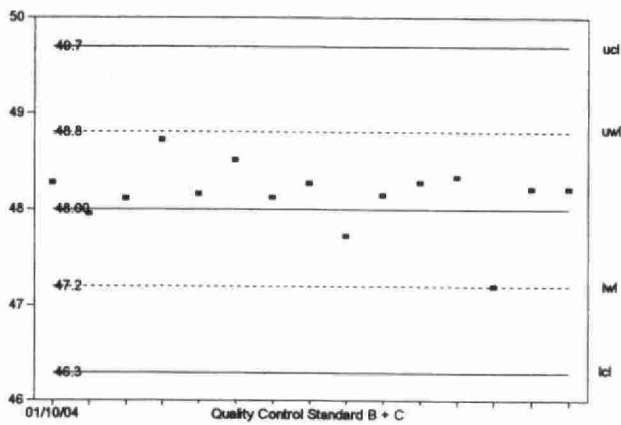
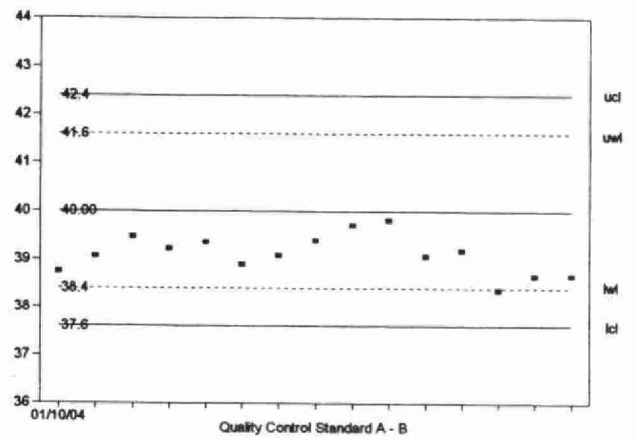
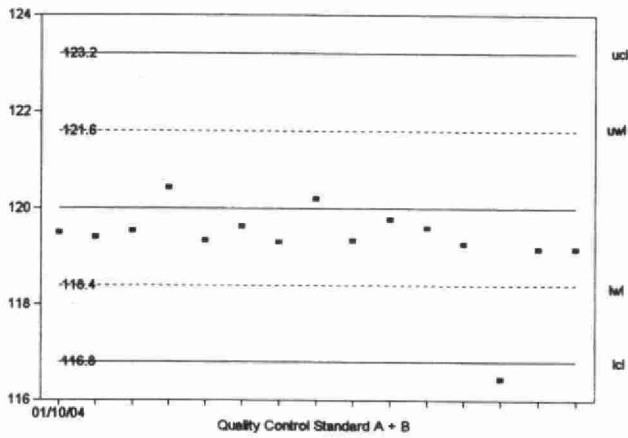
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
9	0.0 - 10.0	0.3195	10.9
10	10.1 - 20.0	0.2889	1.8
19	20.1 - 50.0	0.7178	2.6
5	50.1 - 100.0	1.2231	1.5
43	Overall	0.6651	

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 04/10/01 TO 22/12/01

Analytical Range: to 100.0 mg/L as SO₄



TURBIDITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '74
Method Reference No.	E3311	Reporting Unit	FTU
LIMS Product Code	TURB3311	Supervisor	P. Wilson
Sample Type/Matrix	Surface Water, Ground Water, Effluent, Drinking Water, Industrial Waste, Process Water, Leachate		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

The instrument is standardized with sealed standards which are prepared commercially and rated in Formazin Turbidity Units. Samples are placed in the turbidimeter, and results in FTU are read directly from the digital output. Turbidity measurement are based on light scattering at 90 plus or minus 30 degrees of rotation. The instrument compensates for sample colour.

INSTRUMENTATION:

-Hach Ratio/XR Model Turbidimeter modified to accept control signals from robot controller, electronic interphase, Zymark ZYMATE 11 Laboratory Robot System, IBM PC computer.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus formazin standards (once every four months)

CONTROLS:

Calibration:	5 standards, e.g. QCA
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NOTES: The data for October 29 and November 14 are based on the limits established when new QC standards are being used.

TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 02/02/01 TO 14/12/01

Analytical Range: to 2000 FTU

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
A:	204	2.0	1.60	0.0247
B:	204	20.0	15.58	0.1755
C:	204	200.0	153.63	2.4540
D:	204	2000.0	1345.71	6.2713

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.5215	-	1.6766	for	A (Feb-Aug)
1.5251	-	1.6547		A (Sep-Dec)
15.095	-	16.151	for	B (Feb-Aug)
15.212	-	15.765		B (Sep-Dec)
150.19	-	160.14	for	C (Feb-Aug)
148.20	-	153.92		C (Sep-Dec)
1329	-	1365	for	D (Feb-Aug)
1327	-	1361		D (Sep-Dec)

	n	Data Mean	Standard Deviation (1)
Stray Light	204	0.0234	0.0034

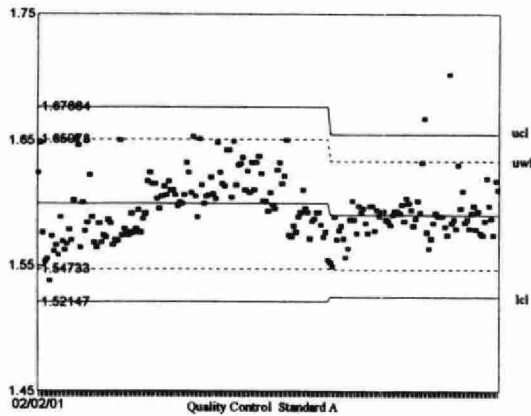
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
370	0.0 - 2.0	0.0630	12.2
172	2.1 - 20.0	0.4054	5.4
62	21.0 - 200	5.0607	10
3	201 - 2000	19.9750	2.5
607	Overall	2.4088	

TURBIDITY (E3311)

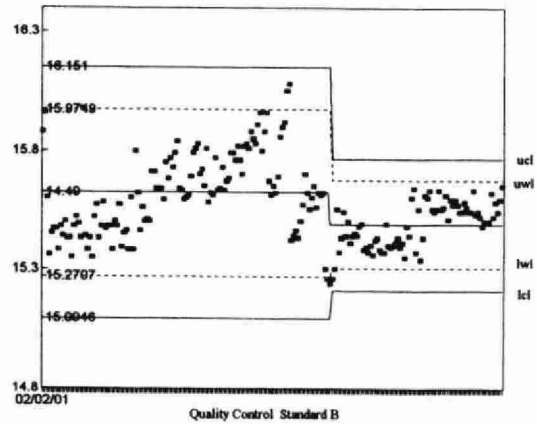
QUALITY CONTROL DATA FROM 02/02/01 TO 14/12/01

Analytical Range: to 2000 FTU



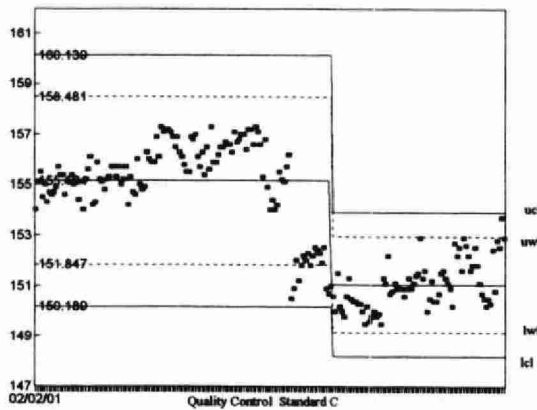
Jan-Aug

Sept-Dec



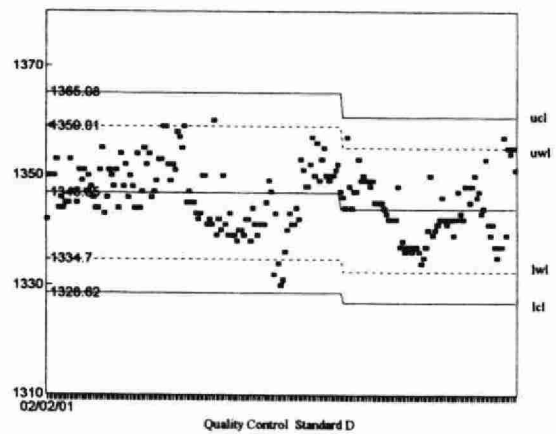
Jan-Aug

Sept-Dec



Jan-Aug

Sept-Dec



Jan-Aug

Sept-Dec

PART 3.0
MICROBIOLOGY

3.1 Quality Control Program, Microbiology Unit

Performance Criteria

Analyses of samples in the Microbiology Unit are performed using approved methodologies, by trained technologists. Safety measures have been incorporated into the methodologies to ensure that all analytical procedures are functioning properly, minimizing the potential to identify and report false positive or negative results. This report focuses on the quality control implemented during sample analyses. Information regarding the implementation of quality control procedures for sample containers, monitoring of the Pure Water supply, media preparation and storage, equipment monitoring are described by the Laboratory Services Branch (4) and Microbiology Unit Standard Operating Procedures (SOPs), approved Microbiology Methods and Lab Services Branch Quality Assurance Manual (2).

Membrane Filtration

Blank Control Analyses

A control (sterile buffered dilution water) sample is processed between each sample analyzed. The control sample is processed in a manner similar to the regular sample including volume, agar used, incubation time and temperature. The blank control should remain free of any bacterial growth.

Duplicate Analyses

Approximately five percent of the samples are analyzed in duplicate per day. The data are accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Presence-Absence Procedure

Blank Control Analyses

Approximately five percent of samples analyzed per day include, a blank control sample prepared by adding a 99 mL dilution blank (sterile, buffered dilution water) to P-A broth and incubating it along with the regular P-A bottles. The blank control should remain free of any bacterial growth and there should be no change in the colour of the broth. Identification of growth or colour change in the control blank requires follow-up of sterility checks in both the P-A broth and the dilution blanks.

Heterotrophic Spread Plate

Blank Control Analyses

Approximately five percent of samples analyzed per day. An open PC plate monitors the air inside the laminar air flow unit and is incubated along with the regular Plate Count agar plates ($35 \pm 0.5^\circ\text{C}$, 48 ± 3 hours).

Duplicate Analyses

Approximately five percent of samples are analyzed in duplicate per day. The data are accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Blank Analyses Corrective Action

The presence of bacterial growth on any control sample by the above techniques (Membrane Filtration, PA Broth, Heterotrophic Spread Plate) indicates inaccurate technique. The supervisor must be consulted with regards to determining follow-up and corrective action. Reporting of results may be tempered by the presence of bacterial growth on these control samples and data qualifying remarks codes would be noted on the final report. Records of all control samples are maintained in the laboratory.

3.2 PERFORMANCE SUMMARIES

MICROBIOLOGY

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth, incubated ($35\pm0.5^{\circ}\text{C}$, for up to 72 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 72 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for *Escherichia coli* are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

***Escherichia coli* (EC)**
E3226

QUALITY CONTROL DATA FOR 2001

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	193	0

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	EC3371, *TCEC3371,*ECFS3371 *,ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
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NOTES:

* TCEC3371,*ECFS3371*,ECFSPS3371 are mixed parameter product codes. See individual tests TC,FS,PSA, for details on medium used and incubation.

***Escherichia coli* (EC)**

E3371

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
83	0-30*	2.55	2.57	26.9
25	31-75	8.84	7.55	15.4
8	76-150	7.88	6.54	6.4

* 42 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2271	1

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
------------	--

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

***Escherichia coli* (EC)
E3407**

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
1	0-30*	N.A.	N.A.	N.A.
0	31-75	N.A.	N.A.	N.A.
0	76-150	N.A.	N.A.	N.A.

* 24 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	507	0

FAECAL STREPTOCOCCI (FS)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	FS3371,*ECFS3371, *ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEnterococcus agar plate and incubated 35±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
------------	--

NOTES:

ECFS3371,ECFSPS3371 are mixed parameter product codes. See individual tests EC,PSA, for details on medium used and incubation.

**FAECAL STREPTOCOCCI (FS)
E3371**

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
54	0-30*	2.98	2.73	20.7
20	31-75	4.85	4.19	8.4
11	76-150	8.72	7.50	7.1

* 11 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	1875	1

HETEROTROPHIC PLATE COUNT(HPC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3408	Reporting Unit	CFU per 1mL
LIMS Product Code	PC3408	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquot is inoculated onto a Plate Count agar plate with a micropipette. The sample is then spread onto the plate using a glass rod and an electronic turntable. The plate is then incubated $35\pm 0.5^{\circ}\text{C}$, 48 ± 3 hours and checked for growth. Target colonies formed on the plate are recorded per 1 mL of sample

INSTRUMENTATION:

Micropipette, sterile micropipette tips, sterile glass rod, electronic turntable, incubator, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicates (5% per day) Negative control per run- open air plate Negative control (5% per day) - glass rod check
------------	--

**HETEROTROPHIC PLATE COUNT (HPC)
E3408**

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/1 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
48	0 - 30*	2.14	2.53	81.8
1	31 - 75	N.A.	N.A.	N.A.
3	76 - 150	4.66	3.74	3.9

*113 duplicate pairs with counts per plate of zero on each were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	227	2

INDICATOR ORGANISMS

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm 0.5^{\circ}\text{C}$, for up to 72 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 72 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for indicator organisms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators

REPORTING:

Detected/Not Detected per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of indicator organisms. Various media are used in their determinations . See method.

***Pseudomonas aeruginosa* (PSA)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	PSA3371,*ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mPA agar plate and incubated 41.5±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
------------	--

NOTES:

*ECFSPS3371 is a mixed parameter product code. See individual test EC, FS for details on medium used and incubation.

Pseudomonas aeruginosa (PSA)
E3371

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs (n)	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
46	0-30*	2.1	2.10	36.4
6	31-75	4.5	3.50	7.0
4	76-150	4.5	3.57	3.8

* 62 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	1651	1

TOTAL COLIFORM (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm0.5^{\circ}\text{C}$, for up to 72 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 72 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Total Coliforms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water
------------	---

NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

TOTAL COLIFORM (TC)
E3226

QUALITY CONTROL DATA FOR 2001

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	193	0

TOTAL COLIFORM (TC)**IDENTIFICATION:**

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	TC3371, *TCEC3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEndo LES agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
------------	--

NOTES:

* TCEC3371 is a mixed parameter product code. See individual test (EC) for details on medium used and incubation.

TOTAL COLIFORM COUNT (TC)
E3371

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
0	0-30	N.A.	N.A.	N.A.
1	31-75	N.A.	N.A.	N.A.
0	76-150	N.A.	N.A.	N.A.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	362	2

TOTAL COLIFORM (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples (5% per day) Blank filter between samples
------------	--

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

**TOTAL COLIFORM (TC)
E3407**

QUALITY CONTROL DATA FOR 2001

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Filter	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
5	0-30*	2.8	2.8	46.5
3	31-75	5	4.4	8.2
2	76-150	N.A.	N.A.	N.A.

* 14 duplicates pairs with counts per filter pf zero on each, were not in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	507	0

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ABBREVIATIONS

AAII	- Auto Analyzer Model II
AAS	- Atomic Absorption Spectrophotometer
Bl	- Blank
°C	- Degree Centigrade
cm	- Centimetre
CS1	- Check Sample 1
CS2	- Check Sample 2
Date	- Day/Month/Year
DO	- Dissolved Oxygen
EDTA	- Ethylenediaminetetra-Acetic Acid, Disodium Salt, Dihydrate
FTU	- Formazin Turbidity Units
g	- Gram
HZU	- Hazen Units
in ²	- Square Inches
IS(n)	- Internal Standard (n denotes parameter)
kg	- kilogram
L	- Litre
LAB	- Laboratory
LIMS	- Laboratory Information Management System
LTB/L	- Long Term Blank
lcl	- Low Control Limit
lwl	- Low Warning Limit
m ³	- Cubic Metre
M	- Molarity
MB	- Method Blank
meq	- Milliequivalent
mg	- Milligram
min	- Minute
mL	- Millilitre
mm	- Millimetre
N	- Normality
N.A.	- Not Available or Not Applicable
nm	- Nanometre
n	- Number
PC	- Personal Computer
Pure-DW	- Pure Deionized Water

ABBREVIATIONS cont'd

Pure-W	- Pure Water
QC	- Quality Control
QCA	- Quality Control Standard A
QCB	- Quality Control Standard B
QCC	- Quality Control Standard C
QCD	- Quality Control Standard D
R	- Recovery
rpm	- Revolutions Per Minute
RS92	- Reference Standard (in -house)
S	- Between Run Standard Deviation
S ₁	- Standard Deviation (Conventional)
S ₂	- Standard Deviation For Duplicates
S _w	- Standard Deviation Within Run
S. Class	- Weight Classification Designation (not certified)
s.d.	- Standard Deviation
Standard Cal	- Colourimeter setting to control electronic expansion
STD	- Standard
TCU	- True Colour Units
TPTZ	- Ferrous-2,4,6-tri(2'pyridyl)-1,3,5,- triazine
ucl	- Upper Control Limit
uwl	- Upper Warning Limit
µm	- Micrometer
µeq	- Microequivalent
µg	- Microgram
µS	- Micro-Siemen
UV	- Ultra-Violet
V/V	- Concentration based on volume measurements
W40	- Whatman 40 Filters
%	- Percent

Appendix A
W and T values for '01

Parameter	Method Reference No.	Units	Full Scale	W	T
Acidity, Gran	(E3248)	µeq/L H ⁺	1000	5.0	25.0
Acidity, Total Fixed Endpoint	(E3248)	mg/L CaCO ₃	1000	0.2	1.0
Alkalinity, Total Fixed Endpoint	(E3218)	mg/L CaCO ₃	1000	0.5	2.5
Carbon, Dissolved Inorganic	(E3370)	mg/L C	80.0	0.2	1.0
Carbon, Dissolved Organic	(E3370)	mg/L C	20.0	0.1	0.5
Chloride	(E3004)	µg/m ³ Cl	14.7	0.1	0.5
Chloride	(E3013)	µg/g Cl	-	0.5	2.5
Chloride	(E3016)	mg/L Cl	100	0.2	1.0
Chlorophyll "a"	(E3169)	µg/L	-	0.2	1.0
Chlorophyll "a" Acidified	(E3169)	µg/L	-	1.0	5.0
Chlorophyll "b"	(E3169)	µg/L	-	0.1	0.5
Colour, True	(E3219)	TCU	100	0.2	1.0
Conductivity	(E3218)	µS/cm	2000	1	5
Cyanide, Free	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
		µg/g CN ⁻		0.01	0.05
Cyanide, Total	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
Cyanide, Total	(E3015)	µg/g CN ⁻		0.01	0.05
Fluoride	(E3369)	mg/L F	2.0	0.01	0.05
	(E3172)	mg/L F	2.0	0.01	0.05
Nitrate	(E3004)	µg/m ³ NO ₃	14.7	0.1	0.5
Nitrilotriacetic Acid	(E3406)	mg/L NTA	1.00	0.01	0.05
Nitrogen, Ammonia Plus Ammonium	(E3364)	mg/L N	2.0	0.002	0.01



Appendix A
W and T values for '01

Parameter	Method Reference No.	Units	Full Scale	W	T
Ammonia Plus Ammonium	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrate Plus Nitrite	(E3364)	mg/L N	5.00	0.005	0.025
Nitrogen, Nitrate Plus Nitrite	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrite	(E3364)	mg/L N	0.200	0.001	0.005
Nitrogen, Nitrite	(E3366)	mg/L N	2.00	0.005	0.025
Nitrogen, Total Kjeldahl	(E3116)	mg/g N	20	0.1	0.5
Nitrogen, Total Kjeldahl	(E3118)	mg/g N	100	0.2	1
Nitrogen, Total Kjeldahl	(E3367)	mg/L N	2.00	0.02	0.1
Nitrogen, Total Kjeldahl	(E3368)	mg/L N	50.0	0.05	0.25
Oxygen Demand, Biochemical	(E3182)	mg/L O	9.0	0.2	1
Oxygen Demand, Chemical	(E3170)	mg/L O	40.0	1	5
Oxygen Demand, Chemical	(E3246)	mg/L O	500	2	10
pH	(E3218)	-	-	-	-
pH	(E3248)	-	-	-	-
Phenolics, Reactive	(E3179)	µg/L Phenol	50.0	0.2	1.0
Phosphorus,					
Reactive ortho-Phosphate	(E3364)	mg/L P	0.100	0.0005	0.0025
Reactive ortho-Phosphate	(E3366)	mg/L P	10.0	0.02	0.10
Phosphorus, Total	(E3116)	mg/g P	5	0.02	0.10
Phosphorus, Total	(E3118)	mg/g P	8	0.02	0.10
Phosphorus, Total	(E3367)	mg/L P	0.200	0.002	0.01
Phosphorus, Total	(E3368)	mg/L P	10.0	0.02	0.10
Silicon, Reactive Silicates	(E3370)	mg/L Si	10.0	0.02	0.10

Appendix A
W and T values for '01

Parameter	Method Reference No.	Units	Full Scale	W	T
Solids, Dissolved	(E3188)	mg/L	-	2	10
Solids, Suspended	(E3188)	mg/L	-	0.5	2.5
Solids, Suspended Ignited	(E3188)	mg/L	-	0.5	2.5
Solids, Total	(E3188)	mg/L	-	2.0	10.0
Solids, Total Ignited	(E3188)	mg/L	-	2.0	10.0
Sulphate	(E3004)	$\mu\text{g}/\text{m}^3 \text{ SO}_4$	14.7	0.1	0.5
Sulphate	(E3013)	$\mu\text{g}/\text{g}$		0.5	2.5
Sulphate	(E3172)	mg/L SO_4	100	0.5	2.5
Turbidity	(E3311)	FTU	2000	0.05	0.25



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Wright, Bernard

Performance report

General Chemistry akmb

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